THE GRASSES

OF

TENNESSEE;

INCLUDING

CEREALS AND FORAGE PLANTS.

BY

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PREFACE.

In the preparation of this work all available sources of information to be had in Europe or America have been consulted. Free use has been made of the standard works of Gray, Flint, Gould and Howard, and also of the reports of the Agricultural Department at Washington, as well as the numerous State reports. The admirable works of Prof. S. W. Johnson, of Yale College, have supplied me with valuable information. I have had access to the various publications of Baron Liebig, the pioneer in agricultural science, and have also derived much aid from the painstaking researches of Wolff and Knop, of Germany; of Johnson, Way, Sinclair, Mechi, Voelcker, Lawes and Gilbert, of England, and from the reports of the Highland Society of Scotland. The little work of Edmund Murphy, of Ireland, has been suggestive. I have relied mainly, however, upon the experience, observation and success of the best farmers of our own State. Reference is made elsewhere to the great assistance received from Dr. W. M. Clarke, Dr. Gattinger and Prof. Hunter Nicholson. The work is the result of much labor, and I indulge the hope that it may be instrumental in directing the minds of our farmers to the importance of the grasses in the solution of the problem of agricultural thrift and prosperity.

It is due to Mrs. Clare Snively, of Nashville, to say that the cuts which appear in the work were executed by her, many of them from original drawings.

Several verbal errors escaped the proof reader, many of which were detected and corrected before the full edition of the book was worked off. On page 14, fifteenth line from the top, there is an error in the statement made. There are in fact about eighty species of sedges and rushes found growing in the State, very few of which are eaten by cattle. The "broomsedge," so called, is not a sedge, but a true grass, belonging to the genus *andropogon*, and forms the chief summer grazing of the Cumberland Mountains. It should be called broom grass.

J. B. KILLEBREW.

July 27, 1878.

To His Excellency, Governor James D. Porter:

Herewith is submitted a treatise on the Grasses and Forage plants of Tennessee. The geographical position of Tennessee eminently fits it to become a great grain and stock-growing State. In 1840, Tennessee was the largest corn-producing State in the Union. Difficult and tedious transportation made it necessary to feed this corn at home, and so in 1850, it took the foremost rank in the production of hogs. The Northwest, with its virgin soil, was able to supply meat and bread cheaper than Tennessee, and it became necessary for her people to turn their attention in another direction. The demand for mules by the cotton-growing States opened a new avenue to agricultural industry, so that in 1860, she became the largest mule-producing State in the Union.

The shock given to all her industries by the war, and especially to her agricu tural interests, by the destruction of her labor system, so disabled her that she bore off no prize in the census returns of 1870. The destruction of her labor system, however, has tended to direct the minds of her farmers to a system of agriculture in which less labor will be required. The sowing of more grass, and the raising of beef-cattle and improved hogs and sheep, will probably show the direction of her growth in the future. The estimates by the Agricultural Department at Washington show a gradual increase in the acreage of land devoted to hay, as indicated by the following table:

The amount, acreage and value of hay produced in Tennessee each year, since 1870, are as follows:

YEAR.	TONS.	ACRES.	VALUE.
1870	155,000	108,391	$2,579,200
1871	124,000	83,783	2,055,920
1872	117,000	96,694	1,808,820
1873	134,500	107,600	2,084,750
1874	114,300	103,909	2,180,844
1875	145,000	106,617	2,354,800
1876	165,000	121,323	2,237,400

The United States census shows the production of hay in Tennessee:

1850	74,091 tons
1860	143,499 "
1870	116,582 "

The total production of hay in the United States for 1870, was 27,316,048 tons, or about 1,400 lbs per head for each inhabitant, while in Tennes

see there were not quite 200 pounds per head, showing that, *per capita*, the people of Tennessee produced only one-seventh as much hay as the average production of the people throughout the United States.

This is to be regretted, for the world over, agricultural prosperity may be measured by the amount of land set in permanent meadows and pastures.

Believing that the tendency of the farmers of our State is to decrease the amount of land devoted to cultivated crops, and to increase the acreage in grass, I have felt that some practical treatise on the management of the grasses would have a great tendency to stimulate the movement in this direction. To meet this want, this work was prepared. In its preparation I have had the aid of Prof. Nicholson, of the East Tennessee University; of Dr. Gattinger, of Nashville, one of the most accomplished botanists in the South, who has devoted the leisure of many years to the study of the flora of Tennessee; and of Dr. W. M. Clarke, who has kindly assisted me in preparing the work for the press. The substantial and ready assistance which these gentlemen have rendered, fully entitles them to share with me in the authorship of the work. I am also indebted to many other gentlemen in various parts of the State, whose contributions will be found scattered throughout the work.

I trust you will pardon me, Governor, for adding, that to no one am I more indebted than to yourself. In discharging the long line of duties devolving upon me by my office, I have been constantly sustained by your gentle encouragement and assisted by your judicious advice. I am sure I utter a truth when I say that no one now takes, or heretofore has ever taken, a deeper or more lively interest in the agricultural prosperity, mental progress and mineral development of the State than yourself.

I have the honor to be,

Your obedient servant,

J. B. KILLEBREW.

March 12, 1878.

GRASSES OF TENNESSEE.

INCLUDING

FORAGE PLANTS.

PART I.

GRASSES IN GENERAL.

In this part, besides giving a general statement as to the importance of grasses in a national point of view, and setting forth the best method of preparing, sowing and treating meadows and pastures, a good deal of scientific matter has been introduced. This has been done because there is springing up all over the State a class of young farmers who, recognizing the value of scientific acquirements in connection with practical skill, earnestly desire to increase their knowledge in scientific agriculture. Just science enough has been incorporated to arouse the ambition of this class to excel in their vocation and to become familiar with the scientific terms, without some knowledge of which it is impossible to make any permanent progress. The description of the grasses is impossible without employing some technical terms, and these terms should be familiar to the ambitious farmer.

A table has also been prepared by which any one of studious habits and an enquiring mind may soon learn to name the grasses with which he is brought into daily contact.

The strictly scientific chapters have been designated by a star, so that the practical farmer who desires only practical information may pass over them. In the other parts of the work the technical or scientific descriptions will be put in small type.

CHAPTER I.

THE IMPORTANCE OF THE GRASSES—PLAN OF THE WORK—FUNCTIONS OF THE GRASSES—EXTENT OF THEIR DIFFUSION AND HOW DIFFUSED—SEDGE GRASS AND OTHER WORTHLESS VARIETIES OMITTED—HOW TO TELL THE GRASSES FROM SEDGES AND RUSHES.

The value of grass in agriculture is aptly stated in the old English proverb:

"No grass no cattle,
No cattle no manure,
No manure no grass."

Each line embodies a truth, and the three form an epitome of successful farming. No surer test of the degree of agricultural advancement of a country can be found than the relative acreage of land laid down to grass and devoted to tillage. Wherever the grass is most abundant there is the highest farming. This statement is most strikingly established by comparing the agricultural systems of France and England. In France 53 per cent. of the tillable land is annually sown in some kind of grain, while in England the grain-bearing per cent. of land is only 25. On the other hand, while France has but 22 per cent. in grass, England has 50. Notwithstanding this difference in the amount of land devoted to grain, the yield of wheat to each inhabitant is almost identical in the two countries. Every acre of grain land in England receives, on an average, the manure from the animals fed off three acres of grass. In France, on the contrary, the manure made from each acre of grass has to be spread over 2½ acres of grain. In other words, each acre of grain in England gets nine loads of manure to one load given to the acre in France.

A further comparison would show that the acknowledged superiority of English cattle, sheep and other domestic animals, over those of France, or any other country for that matter, is due more to the superiority in quality and quantity of the meadows and pastures of that wonderful island than to anything else. If we turn our attention to other countries we shall find that the amount and character of grasses grown may always be taken as a measure of the degree of advancement to which their agriculture has reached. It must be borne in mind that this statement holds good only of the cultivated grasses, but of these it is perhaps universally true.

Under this test the agricultural system of Tennessee falls very low. It is a notable fact, often observed and commented upon, that the great leading, dominating error in the farming of Tennessee has been, and is, the putting too much land in corn and oats, and too little in grass. Under this system a very large breadth of the land has been well-nigh ruined. Indeed the damage is so serious that some change has come to be absolutely necessary. Judging from the experience of other countries, the one and only thing capable of redeeming this almost ruined land and saving the farmers from absolute bankruptcy, is grass.

Fortunately, the climate, soil and geographical locality of Tennessee all combine to render it by nature a grass region. In all the essentials to success in this great branch of agriculture, but few sections of the United States surpass East and Middle Tennessee, while the northern part of West Tennessee is well suited to many grasses. It is not unreasonable to anticipate at no distant day, under an improved system of farming, these natural capabilities will be thoroughly and judiciously developed, and where now are only vast wastes and forest wilds, trackless and uncultivated, rich pastures will bloom and countless cattle roam. But no such result can come without a radical change in

the farming system; and the farmers themselves must make the change.

"Providence helps those who help themselves."

So, also:

"Providence neglects those who neglect themselves."

It is not to be expected that this most desirable change will be made in one year, or in any small number of years; it is not even assumed that the change could be made in a short time. All that can be reasonably hoped for is that some of the more enterprising farmers may take the initiative and make a beginning. By examining the list of grasses given elsewhere, it will be seen that Tennessee bears an abundant harvest, and that a large selection is offered the farmer. But it will not be in attempting experiments, in new or untried grasses that such enterprising farmers will find their interest. For years to come it will be wise and prudent for the great majority of farmers to confine themselves to the improved grasses. Fortunately among the grasses that have been tested are kinds adapted to each, even of the widely various soils of Tennessee.

From the circumstance of the peculiar position of Tennessee as a border State to the cotton belt, she has lost much time in agricultural progress. The large returns of the cotton planters South, and the wonderful ease with which they achieved great wealth, induced those living near to attempt the same role that succeded so well further south.

With how much success this plan met, can be seen in the dilapidated farms, the huge gullies yawning with their ugly yellow faces on every hill-slope. This condition of our State is the more reprehensible when, by our side, are seen the lovely meadows and the sloping, grassy hill-sides of Kentucky, with the inevitable accompaniment of fat cattle and browsing sheep.

Tennessee possesses in her bosom all the elements of a grazing country. Scarcely a foot of land exists in all her borders that will not in an eminent degree meet the wants

of some one or other of the *gramineæ.* Living streams of water, fed by perennial springs, as sweet as those of Castalia, hasten down the mountain slopes and lazily meander through the beautiful valleys. Being midway between the lakes and the gulf, we live just where the warm, moist southern winds encounter the condensing blasts of the north, so that we are rarely the sufferers from droughts. In fact nature intended this State as a grazing region, while man in his thirst for riches has made it what it is. But circumstances are driving us with an irresistable impulse into our proper channel. Blessings on even a large scale are seldom recognized when given, but the roll of years will soon make them visible to all. Had our slaves continued with us, we should probably not have assumed our proper sphere for many decades to come. But, at last, we find ourselves with a large breadth of land that, though greatly worn, is still full of fertility, and without due labor to cultivate it in the old style. What is more, the only way in which these lands can be restored to their pristine condition is the very way to redound to the permanent wealth of the State. This is by removing Tennesssee from her geographical position. Not changing her longitude or altering her latitude, but by simply converting her from a fourth-rate cotton State into a first-class grazing country.

Grass is wealth. As lowly and humble as it appears, it comprises about one-sixth of all the vegetation of the world. It nourishes more animals than all other food combined, and furnishes all the elements for the growth of man.

It is true man cannot, like Nebuchadnezzer, feed as a beast of the field, but he can and does appropriate this food after it has been assimilated to his requirements by the ruminants. Not only this, but through its wonderful chemical and vital properties it extracts from the great laboratory of nature—the atmosphere—certain gases and fluids hostile to man's respiratory organs, thus purifying

the air for his use, and deposits these elements in the soil, thereby enriching the earth. Hence the adage with which we set out, "no grass no cattle, no cattle no manure, no manure no grass."

This explains it all. Grass enriches the land and fattens cattle, cattle feeds man and makes manure, manure enlivens the soil and makes crops. There is an eternal revolution in this. Nothing is lost in this circle. Nature repeats here her great law of the indestructibility of matter.

But all soils are not good producers of any one kind of grass.

Nature, in her benificence, has provided for this, for besides the legumens that are classed as artificials, we have about one hundred and thirty different varieties of the true grasses, including cereals. Thus the marsh and the sandy, thirsty hill-sides, the loamy valleys and the rock-ribbed mountains, the shrubby barrens and the alluvial bottoms, are all alike provided with a congenial growth. The love of the pastoral has ever existed since man took possession of this rich heritage. It has ever held a first place in the songs and poetry of the world. While the grand epics of Homer have stirred the hearts of the warlike, and made them clash the spear against the sounding shield, the gentle idyls of Virgil have recalled man to the sweets of domestic happiness. The piping reed of the peaceful shepherd has no less charm for humanity than the spirit-stirring drum and fife, or the joyous vibrations of the passionate violin. Art has also emulated poesy in portraying its loveliness, and the landscape is never perfect on the canvass, unless gamboling lambs or grazing herds occupy some prominent place in the picture. A traveler passing through such a scene has his eye constantly delighted with the ever changing panorama. The hay wagon, with its fragrant loads, passing to the teeming barns; the beautiful hill-sides, carpeted with its cloth of green; the grain field, with its billowy waves, swayed back and forth by the gentlest kisses of

the breeze, while the tall plumes of the maize keep watch and ward over the plains, all contribute to the joy and happiness around.

Fat cattle and bunchy sheep fitly adorn the deep green of the meadows, and is one of the highest evidences of a high civilization.

There are many kinds of grasses, and they seem to be so far apart in appearance, habits, etc., that they would scarcely be considered as being allied; yet the necessary classification, depending upon the flowers, leaves, stems and roots botanically connects them.

They are divided into two general classes, natural and artificial. The former includes those grasses with long, simple, narrow leaves, with a prominent mid-rib or vein in the center, and smaller ones running parallel to it, and at the base, the leaf divides and clasps the stem in such a way that the stem seems to pass through it. As a rule the stem is hollow and closed at the joints, though a few are solid stemmed. The classification of grasses would be impossible were their general appearance only considered. So great are the changes produced by modes of culture, by soil and climate, botanists, to arrive at the precise plant, therefore, have adopted characteristics that undergo no change, such as flowers, etc. From the rule of botanists in giving all plants technical names, it would be a difficult matter to recognize an old familiar friend under the new guise of a generic term, but we will endeavor, by giving also the name in common use, to remove this difficulty and bring them within the comprehension of any one who will take pains to properly read the descriptions.

Artificial grass includes all leguminous plants, such as clover, peas, beans, etc., while cereals, such as maize, wheat, oats, barley, rye, rice, sorghum, dhouro, chocolate, corn and broom-corn, though really true grasses, are generally classed with the artificials.

In the limits of this work it would be impossible to give a full discription of all known gramineæ, so those will be considered only that are indigenous or acclimated to the soils of Tennessee, and especial attention will be given to the proper application of the grasses as adapted to the differing soils of the State. For our botanic descriptions we will, for sufficient reasons, follow those laid down by Dr. Gray in his standard work on botany.

But it is not our intention to describe them under the scientific arrangement adopted by all writers on the subject into orders, genera and species, for this book is not intended as a purely scientific work, but rather as a practical hand-book for farmers. Hence, although the botanical names will in each species be given, they will be treated under a practical head. Therefore, all grasses will be classified as:

1*st. Meadow, or hay grasses.*

2*nd. Pasture, or grazing grasses.*

3*rd. Wild, or grasses of no known agricultural value.*

4*th. Cereals.*

The term wild is not to be taken in a literal sense, for many of them will grow on spots too rocky, sandy or barren to produce other kinds, and they serve a useful purpose in many ways. Sheep and goats will eat many of the wild grasses rejected by horses or cattle, and all furnish seeds to feed the feathered denizens of the air; besides, they assist in pulverizing the soil, disintegrating rocks, promoting moisture, beautifying the earth with a carpet of living green and in their death leave a rich legacy of fertility to the soil.

There is an innate love of the beautiful in man, and many who turn in disgust from the most fragrant exotics will contemplate with great satisfaction the little spot of verdure at their door-stoop.

These grasses perform important functions in nature; extracting saline matters from the rocks, nitrogen and carbon from the soil, ammonia, oxygen and hydrogen from the

moisture, and by their vital forces, they assimilate these elements into the necessary nutriment for man's use.

As has been already stated, one-sixth of the vegetation of the world is composed of grasses. There are not less than 3,000 distinct species known to botanists, and in the following pages we have a list of 130 for Tennessee, including the cereals. A botanist of eminence took up a square foot of sward in a rich pasture, and was able to identify on that one square foot, 1,000 plants, composed of 20 distinct species.

Nor are grasses confined to any particular part of the earth. They thrust their tiny leaves out of the snows of the arctic regions, and rear their majestic heads, in the form of canes, in the jungles of the tropics, rivalling in height the forests around. They push their green tufts from the crevices of the tallest Alps, tempting the chamois to marvellous leaps, and on the sandy, arid deserts of Arabia they quicken the pace of the camel of the caravan. No marsh so brackish but has its fringe of luxuriant grass, no spot so bleak but has its cloak of verdure. Nor are they confined entirely to the surface of the earth, for who has not admired the beautiful winter bouquets filling the vase with feathery loveliness, or the tussocks of the gardener adorning the pit or the green-house?

To one acquainted with the subject, the facility with which grass scatters and diffuses itself is very surprising. But it seems that so important a vegetation should not be subject to the fancies or caprices of man. Therefore, the seeds are prepared in such a way, that they are self-sowers. It is this remarkable facility of transportation that has given rise to the surmise of many, that it grows by spontaneous generation. Some of the seeds have hooks, and by these they fasten to any passing animal and are carried for miles. Others lie undigested in the crops of birds, or maws of animals, and are scattered with the dejectæ. Snows gather them on the hill-sides and bear them far away on the

melting torrents, and scatter them, mayhap, along some foreign shore. The air also assists in this, and lifts them on its wings and they fly in all directions. When grass once stands, even if a passing beast cuts off its annual supply of seed, its rhizomes or creeping roots thrust their tender spongioles through the yielding soil, and thus, many a field is clothed with verdure. And besides, many of the grasses are perennials, and though torn and tramped by stock, they gather new strength for another year, and push on their foothold.

There is a large class of so-called grasses, purposely omitted, from the fact they are but little known and of no agricultural value, with only one or two exceptions. These are the rushes and sedges. There are about 500 varieties of those plants growing in the United States, principally on the borders of salt marshes on the coast, but with the exception of the broom-sedge *Carex scoparia,* the species are almost unknown in Tennessee.

However, on the sea-coast, these plants form an important part in feeding the stock; their stems when young and tender, are eaten by cattle, when nothing better presents itself. The rushes enter also, considerably into manufactures, the reeds being used for many purposes, such as chair bottoms, baskets and hats. Some farmers also annually cut these marsh grasses, and feed to stock during the long, severe winter. It is commonly known as *swale hay.*

Many of the large, coarse grasses that border our ponds and mat in our swamps, and are looked upon as *sour grasses,* belong to these species. They serve their purpose in eliminating the miasmatic gases that are continually being generated in the ponds, from the atmosphere, thus protecting man from their deleterious influences. Besides, they fringe with their green, wavy heads, these collections of water, giving a beauty to the otherwise repulsive swamps.

Their roots are perennial, and with but few exceptions, creeping. Hence the folly of assaying their destruction by digging them up. A tuft of broom-sedge may be easily

dug up, but its rhizomes, or creeping roots, are in the ground for yards around, and a piece left an inch long, is sufficient to give it another start. The only way to destroy it is by cultivation and seeding to a more vigorous grass. Japan clover is said to have the quality of rooting out and destroying broom-sedge effectually, but has not received sufficient trial to give it full credence.

There is a simple method of separating the grasses from these rushes and sedges, which will be briefly stated.

The sheath of sedges is a hollow tube, through which the stems pass, and it cannot be removed without tearing it open. This is not the case with grass, as the sheath can be stripped down, it being open to the joint. Besides, the leaves of all grasses are two-ranked, that is, the stem has leaves on each side, some opposite, others alternate, but always only on two sides. The leaves of sedges are three-ranked, or come out on three sides of the circle of a stem. In other words, the stem forms a circle of 360 degrees. The grass leaves are 180 degrees from each other, and the sedge leaves are 120 degrees apart.

In the grass-like rush the flowers are divided into six points, within which are six stamens and a triangular ovary containing three seeds. A grass has never but one seed to the ovary.

The object of this work is not merely to talk of the many varieties of grasses and their wonderful beauty, but to add to the intrinsic value of the farming lands of the State. The ignorance of the difference between the many species of grasses is vast and general. It pervades all classes and occupations. The farmer, himself, who depends so greatly on this provision of nature, is not exempt from this want of knowledge. Ask him the name of a grass of unusual character, and he will refer you, probably, to a son or daughter who, he will tell you, has been studying botany. As for him, he has no time to fool with such stuff. And yet this want of knowledge has given a firm foothold to some of the

greatest pests the farmer ever experienced. A gentleman in New Orleans, importing some exotics from Cuba, found a delicate sprig of grass in a pot, and thinking it might possibly be some rare plant, set it out in his garden, and thus was introduced the terrible scourge of the South, the *Cocoa grass*, and from this small start, it has spread and diffused itself over half the country. The same want of knowledge brought from Europe the seeds of the cheat, and it will ever remain as a curse to the wheat grower. Our lands are everywhere covered with grasses of various kinds, but few are the farmers who can tell the kinds most sought by stock in grazing. But a careful perusal of the following pages will disclose the fact, that, of the many varieties indigenous to the State, but few have a sufficiently nutrient character to make them valuable or desirable.

Farmers should be able to make important discriminations, and when they find a fertile soil covered with noxious weeds or useless grasses, they ought to be able to eradicate them, and substitute such as will improve the value of the land and also add to its beauty.

A case has been brought to my notice, in which the value of such knowledge proved quite profitable. A gentleman of Davidson county, some 25 or 30 years ago, owned a large and fertile tract of land. He became impressed with the value of blue-grass, and bought at one time fifty bushels of blue-grass seed, and scattered it over a woods lot containing 75 or 80 acres of rich, black limestone land. That woods lot became the pride not only of the farm, but of the neighborhood. It proved a blessing, for many years, to his horses, cattle and sheep, and when, by the exigencies of the hard times, he was compelled to sell his land, it was divided into small tracts and put up to the highest bidder. That blue-grass lot was sought by all the bidders, and at last was knocked down at more than double the price per acre of any of the other lots, though it was, aside from the grass, of no more value than the remainder.

Thus, if we wish to make our farms not only a beauty and a pleasure, but also to make them profitable, we ought to sow them down with good grasses. Look over the list, examine the land desired to be sown, and select the one most suitable to its requirements. There is no fear but what one can be found. If it is such as will not grow blue-grass, there is the fescue, or vernal, or clover, or timothy, or herds grass, and many others equally good. We have them for limestone or sandstone soils, for rocky or gravelly, for uplands or lowlands. Let no one be afraid to try, if one kind fails, through any mistake, try another. If the frosts or sunshine destroy the first stand, sow for another. The seeds are, or should be, but a small obstacle to the general results. If one should ever want to sell, it will be less difficult to make the sale, and at a higher figure. Should a farmer never wish to sell, it will repay him an hundred fold with its cheering aspect, with fat cattle, fat sheep and sleek horses.

CHAPTER II.

ENGLISH PRODUCTIONS COMPARED WITH THOSE OF TENNESSEE—COMPARATIVE VALUE OF OTHER CROPS WITH GRASS—CAUSE OF LOW PRICE OF LANDS.

Cotton has been for so many generations recognized as the king of all agricultural products, that the people of Tennessee were long disposed to accept his prerogative without questioning, but when the subject is fully investigated, grass takes precedence. The cotton crop of the United States as a general thing reaches about 4,000,000 bags, worth about on an average $250,000,000, while the aggregate of the hay receipts annually reach the enormous sum of $300,000,000, and the value of pasture will fully equal this amount, though its results are not so immediately apparent, as its sales are combined with those of cattle, sheep and hogs. Before the war, the lands of Tennessee had a certain fixed or rising value. A great depreciation of prices has taken place. But this falling in price does not apply to those well arranged stock-farms, scattered here and there, at long intervals through the State. They are still in demand at prices far in advance of those lands that have been, and are still being devoted to cotton and other exhaustive crops.

The English farmer is able to take long leases of farms from the rich landholder, at from $20 to $50 per annual rent. How does he pay this extravagant rent and support his family? He could not do it in any other manner than by improving, manuring and increasing the meadows with which they are constantly set. A Tennesseean will manure his garden, and sometimes his corn land, but whoever thinks of spreading manure on his meadows. Yet the Englishman will spend large sums of money, and de-

vote labor through the whole winter, in accumulating a large compost heap to apply to his meadows! The result may be imagined. While the Tennessee meadows will average from 800 to 1,500 pounds of hay to the acre, English meadows will make from two to five tons on land that has no other advantage than the care bestowed on it by the owner.

Besides this, the grass grown in a damp cold climate is never so sweet and nutritious as that raised under a warm sun and with a quick growth. In this State there is an occasional drought that begins in June or July, interfering seriously with the development of the later crops. But such a condition of climate is scarcely known in the earlier months during the growth of the grass crops. Yet there is with the spring rains a degree of temperature unknown to the Englishman, a degree sufficiently high to give grass all the necessary heat to enable it to attain its full supply of sugar and nitrogen from the soil.

The beautiful lands of Kentucky and Missouri, to say nothing of the Northern States, still retain a great value, and are in great demand at high prices. It is because these States have more land in meadows, while broad stretches of valuable pastures and prairies dot the landscape in every direction. Poor land will not make much grass, and without a great outlay of capital land cannot be placed in first-class order at once. But it only requires a start, and then the persevering, provident farmer will soon see his farm blossoming as the rose. Land in Europe not infrequently reaches the sum of $1,000 per acre for purely agricultural purposes, while here it is a difficult matter to extract, with our best farming, $50 per acre, and then the expenses are to be drawn from that meager sum.

Let us draw a comparison between our leading staples. Cotton here will make on average land 800 pounds seed cotton per acre. This at the usual price makes $20 per acre. Corn will produce on good land eight barrels per acre, and at

$2.00, the laborer will get $16. Tobacco, our most remunerative crop, on good land will make 800 pounds of leaf, which is about $50 to $60 per acre. Wheat will make, on good land, fifteen bushels per acre, and at $1 will yield about $15. Taking the cost of production from these amounts, the average farmer will not have left, at the best, more than twelve dollars per acre. A good meadow, in full bearing, with ordinary care, will yield, with two cuttings, at least two tons per acre. The cost is altogether in harvesting, while the trouble of sending to market is no greater than either of the other crops. This, at the price for which it has been selling for several years, will be $20 per ton. Here, then, is a difference in actual receipts of almost double that obtained from other crops, nothing paid out for production, and besides the land can be enriched year by year, until it attains an almost fabulous fertility. Nor is this all. The amount of hay produced from a single acre can be increased almost to any extent by the application of stimulating manures. If then, land in Europe can produce five tons of hay per acre, and sell for $1,000 per acre, why cannot Tennessee lands, far better naturally, and in a more genial climate, be made to rival these results? One thing only prevents, and that is the fatal apathy and want of enterprise on the part of the land owners. It is the thirst for immediate returns. To create this state of tillage, it will be necessary to proceed slowly, and look for no returns of consequence for one or two years. Pressing necessities weigh upon the farmer, and he thoughtlessly drives on in the same interminable furrow, regardless of the loss of time and fertility. The Northern husbandman bales his hay, and is able to ship it to all parts of the South in search of a market, and after paying heavy railroad charges, is still able to sell his producee at a remunerative price. The Southern man has no freight charges to tax his hay, and yet he is content to let his Northern rival enjoy, without competition, this great market. When will our eyes be

opened to our interests, is a question often asked, but difficult to answer.

A capitalist invests his money in United States bonds, and without risk or labor contentedly cuts off his coupons and enjoys his ease, while the merchant, with the same capital, is harrassed to death meeting bills, collecting accounts, and watching with unceasing vigilance the turn of the markets. So it is with farmers. A prudent farmer will invest his farm-capital in grass, and he contentedly watches the growth of the grass and the browsing of his cattle, while his neighbor raising corn and cotton, is busy all the year in cultivating his crops, watching his laborers, buying mules, bacon and hay from his more prudent friend, and when he counts his receipts at the end of the struggle, he will find his neighbor has absorbed the greater part of them. Not only this, but a stranger appears in the country desirous of investing in land, and while he would turn from the cotton plantation at ten or twelve dollars per acre, he would gladly invest in the grass farm at forty or fifty dollars per acre.

Land that will yield ten or fifteen dollars per acre clear of the expense of cultivation, cannot be supposed, and is not entitled, to the same value with land that will produce thirty to forty dollars on the same breadth. And yet the farmers of Tennessee hesitate to pursue this course. Dr. Gulliver, in the midst of his extravaganzas, uttered a truism that will go down to all ages when he said "the man who makes two blades of grass grow where one grew before, is a great public benefactor;" and when the citizens of Tennessee look at their own interest in a proper light, they will realize this truth, and then by acting on it, double or even quadruple the intrinsic value of the lands of the State.

Grasses mean less labor, less worry, fewer hands, more enjoyment, finer stock and more charming homes, and as a consequence, happier families, more education, more taste

and refinement, and a higher elevation of the moral character. Let grasses be sown and our homes beautified and there will be more contentment, more satisfaction, less gloom and despondency, less carping and discontent.

It is almost impossible for us to realize the splendid future that would await us in such an event. We are groaning under the burdens of a heavy debt incurred by our State in a more prosperous time. Now it is with difficulty the interest can be paid, and our creditors are alarmed at the possible loss of the debt Should more meadows and pastures be established, and the lands prove themselves to be, as we know they are, a tide of immigration, of a character to be desired, would pour into our borders, the lands would be quickly cut up into smaller farms, and the returns would so increase their value, we could pay the whole debt as easily as we can now meet the interest.

But, some will say, how can this be done? On the general principle that what has been done by one man can, under the same or similar circumstances, be done by all. The amount of hay, on a given amount of land, can be raised from 800 pounds to the acre, to five tons or 10,000 pounds, simply because it has been done.

Were we confined to any one species of grass, with the great diversity in the character of our soils, we might well exclaim against the chances of success, but fortunately such is not the case. There are a great many to select from, and he who has a farm with several kinds of soil, can make such selections as suit the different requirements, or he can mix the seeds of various kinds, if he labors under any uncertainty in regard to its capability.

The cultivation of the grasses in Tennessee is yet in its infancy. It is true some have been engaged in it for years with eminent success, but to the masses it is a sealed book. Many have attempted it, and from a want of knowledge of judiciously selecting seeds and the proper time and manner

of sowing, have failed, and, discouraged, abandoned it. Many, and a majority, are content to secure such precarious spots as are self-sown, or where seeds have been distributed by nature, and still exhaust their lands by cultivation.

C. W. Howard, of Georgia, who devoted years to the investigation of the influence of the grasses upon civilization and material progress thus presents the subject in a strong light:

A planter owning one thousand acres of fair average land in the healthy portion of the cotton States is a poor man. He could not sell his land probably for more than $5,000. He looks to the North, and finds lands ranging from $50 to $200 per acre. He looks to England, Holland and Belgium, and finds the price averaging from $300 to $500 per acre. Why this difference? Is the land in these countries better than ours? Not by nature—if it be better it is by the difference of treatment. Is their climate better than ours? The acknowledged superiority is on our side. Are the prices of their products any better than ours? On an average not so good. Are the taxes lighter than ours? If we were compelled to pay their tax either at the North or in England our lands would at once be sold for taxes. Have they valuable crops which they can raise and we cannot raise? There is not a farm product in either Old England or New England which we cannot raise in equal perfection at the South. Is the labor cheaper than ours? The cost of labor at the North nearly doubles the cost of labor South. In England labor is cheaper than with us. But the difference is perhaps compensated by the poor and church rates and excessive taxes paid by the English farmers.

If our climate is as good as that of the countries referred to, if our lands are as good as theirs, if our products bring as good prices, if we can grow all they can grow, if labor is cheaper with us than at the North, and if difference in taxes compensate for the cheapness of labor in England, why is it that their lands are so valuable and ours so valueless?

We shall find the map of use to us in answering this question. If we take the map of the United States, and put our finger upon the States or parts of States in which lands sell at the highest price, we shall find that in those States, or parts of those States, the greatest attention is paid to the cultivation of the grasses and forage plants. If we open the map of Europe we shall find that the same rule holds good. The cheapest lands in Europe are those of Spain. where little attention is paid to the grasses.

The value of land rises exactly in proportion to the attention which

is given to them, in England and Holland, reaching, for farming purposes, $1,000 per acre. Holland is almost a continuous meadow. This land value culminates in Lombardy, where irrigated meadow lands rent for $60 to $100 per acre. Without exception, in Europe and America, where a large portion of land is in grass or forage crops, the price of the land is high, reaching the figure as above mentioned. On the other hand, without exception, wherever in either continent the grasses do not receive this attention, landed estate is comparative of low value.

These remarks are more applicable to Tennessee than to Georgia, for the latter State is strictly within the cotton belt, while Tennessee belongs strictly to the great grain and grass-growing region of America. Her natural destiny is to feed the population of the Cotton States, and supply them with domestic animals, and she will never realize the full wealth of her real estate and climate until grass and stock take the place of cotton and corn.

CHAPTER III.

HOW AND BY WHOM GRASSES HAVE BEEN IMPROVED—WOBURN EXPERIMENTS—EXPERIMENTS OF LEWIS AND GILBERT—WAY'S EXPERIMENTS—ANALYSIS OF GRASSES—TABLES BY WOLF AND OTHERS.

Although, since the time of the oldest records, a large proportion of mankind have been "keepers of flocks and herds." it is only within the last century that any systematic and successful efforts are known to have been made toward selecting and improving the grasses of the meadow and pasture. And even to this day the value of a large majority of the grasses known remains to be tested by any exhaustive and trustworthy experiments. The knowledge which botanists have of the grasses would be of but little value to the farmers if they possessed it, since it is confined almost entirely to the mode of blooming, shape and flower and leaf, and other minor details, quite important and essential to classification, but almost useless for any practical purpose on the farm. What the farmer needs to know about a grass is its nutritive value, its time of blooming, its habit of growth, and favorite locality. He is interested in knowing how much food it will furnish, at what time of the year, in what form, and from what character of soil. These are questions with which botanists have not, heretofore, concerned themselves, but which must be answered, now that farmers' sons are beginning to learn botany and chemistry.

The first impulse was given to grass cultivation in England by the London Society for the Encouragement of Arts, Manufacturers and Commerce, which, in 1766, offered prizes for "gathering by hand the seeds of Meadow Foxtail, Meadow Fescue and Sweet Vernal Grass." The success of

this offer was such as to induce the same society to offer, in 1769, *a gold medal* to the person who should give the best account of the properties and comparative values of any two or more natural grasses. Previous to this sufficient attention had been given to the grasses to establish the terms natural and artificial grasses—the latter being applied to the plants selected fer cultivation in meadows and pastures, but which are not really grasses. As yet, however, no systematic efforts had been made to test, by experiment or analysis, the relative values of the several grasses. In 1822 this attempt was made by the Duke of Bedford, who set his gardener, George Sinclair, to work to collect all the natural grasses of England into a grass garden, the first of the kind ever attempted in England. In this garden, and another, subsequently established for himself by Sinclair, a long series of experiments were tried with the various grasses, testing with admirable patience and skill their properties and qualities. While it is true that the chemical tests applied by Sinclair were too meager and simple to command our implicit confidence, more valuable lessons concerning the grasses have never been taught than are contained in Sinclair's accounts of the "Woburn Experiments," in his book called "Graminea Woburnensis." Many of these lessons have come to be accepted as fundamental truths. He first taught, that from early spring to late in winter there is no time when there is not one or more of the grasses in prime condition, some containing most nutriment before flowering, some while in flower, others while in seed, and others still, owing their chief excellence to their aftermath. He taught also what grasses flourished best in dry weather, and what in wet. In short he laid the foundation for the scientific study of the grasses, and all subsequent investigations have but enlarged upon his work.

In 1845, Prof. Way, Consulting Chemist of the Royal Agricultural Society of England, undertook the analysis of the principal grasses with a view of ascertaining their rela-

tive values as flesh, fat and heat producers. These analyses were conducted with that consumate skill and patience which characterized all of Prof. Way's work, and their result stands to-day as the best authority of the laboratory on the values of the different grasses.

Between the writings of Sinclair and Way a revolution had taken place in chemistry. Organic or physiological chemistry had developed relations between the mineral, vegetable and animal kingdoms, not even suspected in the time of the earlier writer, and, far from being fully understood even at the present time. It was this chemical progress that induced Prof. Way to undertake his work. He was fully aware, and was careful to state, that his analyses were only so many facts, to be taken along with many other known and unknown facts in physiology, before a true estimate could be formed and a final conclusion arrived at.

Next in order came the experiments of Messrs. Lawes and Gilbert, of Rothamsted, England, which were designed to ascertain "The Effects of different Manures on the Mixed Herbage of Grass-land." The experiments extended over a period of seven years, and were conducted with every conceivable caution and care, and with a minuteness unequaled in any other experiments. The results of these experiments, while they modify in many points, and in some overturn, the conclusions of both Sinclair and Way, on the whole add value to their works by furnishing a better interpretation of their facts. To the farmer the experiments of Lawes and Gilbert are invaluable.

In England, in the meanwhile, quite a number of books and pamphlets had been printed on the grasses by botanists, agriculturists and seedsmen, all of more or less value, but none of material importance to the American farmer.

In America, too, books have been written on grasses, one entitled "GRASSES AND FORAGE PLANTS"—"A practical treatise, comprising their natural history; comparative

nutritive value; methods of cultivating, cutting and curing, and the management of grass lands in the United States and British Provinces," by Charles L. Flint, Secretary of the Massachusetts State Board of Agriculture. The other entitled "The Grasses and their Culture," by John Stanton Gould, of the New York State Board of Agriculture. Mr. Flint's book was published in 1859, and at once took rank as a hand-book of the subject. It was based upon the preceding works of Sinclair and Way, and is the best application of their several experiments made up to the year 1859. The work is profusely illustrated, and will be found exceedingly useful by every intelligent farmer. The essay of Mr. Gould was prepared for the transactions of the New York Agricultural Society, and has not been published in a separate book, that we know of. It is, however, well worthy of such publication.

So far as to the literature of the grasses in book form. In the agricultural journals, and in the transactions of the various State and County Agricultural Societies, there have appeared from time to time many excellent essays upon the grasses. The late Dr. Wm. Gordon contributed many excellent papers to various journals in Middle Tennessee on the grasses of that section, but so far no attempt has been made to form a complete list of the grasses of the State.

The following are the natural grasses examined by Prof. Way:

BOTANICAL NAMES.	COMMON NAME.	DATE OF BLOOMING	NATURE OF SOIL.
Anthoxanthum odoratum........	Sweet-scented vernal grass.......	May 25.........	Loam and calcareous rubble.
Alopecurus pratensis............	Meadow fox-tailed grass	June 1.........	Calcareous loam, gravelly subsoil.
Arrhenatherum avenacum	Common oat-like grass..........	July 17.........	Forest marble loam.
Avena flavescens................	Yellow oat-like grass...........	June 29.........	Forest marble loam.
Avena pubescens...............	Downy or oat-like grass....	July 11.......	Dry calcareous loam.
Bromus mollis...................	Soft brome grass...............	May 8.........	Stiff loam.
Bromus erectus.................	Upright brome grass............	June 23.........	Calcareous loam.
Briza media.....................	Common quaking grass..........	June 29...... ...	Forest marble loam.
Cynosurus cristatus............	Crested dog's tail grass..........	June 21.........	Forest marble loam.
Dactylis glomerata.............	Cock's foot or Orchard grass.....	June 18.........	Calcareous loam and gravel.
Dactylis glomerata, ripe seed.....	Cock's foot or Orchard grass.....	July 19.........	Calcareous loam and gravel.
Festuca duriuscula.............	Hard fescue grass..............	June 13.........	Dry calcareous loam.
Holcus lanatus	Soft meadow grass.............	June 29.........	Dry calcareous loam.
Hordeum pratense.............	Meadow barley	July 11.........	Dry calcareous loam.
Lolium perenne.......	Rye grass or darnel	June 8.........	Calcareous rubbly loam.
Lolium Italicum....	Italian rye grass......	Jnne 13.........	Forest marble loam.

This Table show the Analysis of the Principal Natural Grasses. (Way.)

BOTANICAL NAMES.	Water.	Albumin'us or flesh forming.	Fatty matters.	Heating—starch, gum sugar, etc.	Woody fibre.	Mineral matter--ash	Date of collection.	Condition.
Anthoxanthum odoratum	80.35	2.05	.67	8.54	7.15	1.24	May 25.	In bloom.
Alopecurus pratensis	80.20	2.44	.52	8.59	6.70	1.55	June 1.	"
Arrhenatherum avenacum	72.65	3.54	.87	11.21	9.87	2.36	July 17.	"
Avena flavescens	60.40	2.96	1.04	18.66	14.22	2 72	June 29.	"
Avena pubescens	61.50	3.07	.92	19.16	13.34	2.01	July 11.	Seed ripe.
Briza media	51.85	2.93	1.45	22.60	17.00	4.17	June 29.	In bloom.
Bromus erectus	59.57	3.78	1.35	9.04	8.46	2.11	June 23.	"
Bromus mollis	76.62	4.05	1.47	9.04	8.46	1.36	May 8.	"
Cynosurus cristatus	62.73	4.13	1.32	19.64	9.80	2.88	June 11.	"
Dactylis glomerata	70.00	4.06	.94	13.30	10.11	1.59	June 13.	"
Dactylis, seeds ripe	52.57	10.93	.74	12.61	20.54	2.61	July 19.	"
Festuca duriuscula	69.33	3.70	1.02	12.46	11.83	1.66	June 13.	"
Holcus lanatus	69.70	3.49	1.02	11.92	11.94	1.93	June 29.	"
Hordeum pratense	58.85	4.59	.94	20.05	13.03	2.54	July 11.	"
Poa annua	79.14	2.47	.71	10.79	6.30	.59	May 28.	"
Poa pratensis	67.14	3.41	.86	14.15	12.49	1.95	June 11.	"
Poa trivialis	73.60	2.58	.97	10.54	10.11	2.20	June 18.	"
Lolium perenne	71.43	3.37	.91	12.08	10.06	2.15	June 8.	"
Lolium Italicum	75.61	2.45	.80	14.11	4.82	2.21	June 18.	"
Phleum pratense	57.21	4.86	1.50	22.85	11.32	2.26	July 16.	"
Trifolium pratense. (clover)	81.01	4.27	.69	8.45	3.76	1.82	June 7.	In bloom.
Trifolium repens (white clover)	79.71	3.80	.89	8.14	5.38	2.08	June 18.	"

This table exhibits the theoretical value of these grasses as they are gathered from the field, and may stand for their pasture value. It must be borne in mind, however, that pasture grasses are rarely allowed to come into bloom before cattle are turned in on them, so that these estimates will not hold absolutely true. Grasses differ widely in the amount and character of their foliage, which is an important element in any estimate of their value for pasturage. Again, some of the most esteemed grasses owe their value chiefly to the fact that they appear at a time when they are much needed, that is, in early spring, rather than to their absolute richness.

We give below another table of the same grasses dried at 212° Fahrenheit:

NAMES.	Albumino's	Fatty matter.	Heating—starch, etc.	Woody fibre.	Ash.
Anthoxanthum	10.43	3.41	42.48	36.36	6.32
Alopecurus pratensis	12.32	2.92	43.12	33.83	7.81
Arrhenatherum avenacum	12.95	3.19	38.03	34.24	11.59
Avena flavescens	7.48	2.61	47.08	35.95	6.88
Avena pubescens	7.97	2.39	49.78	34.64	5.22
Briza media	6.08	3.01	46.95	35.30	8.66
Bromus erectus	9.44	3.33	41.71	36.12	5.21
Bromus mollis	17.29	2.11	38.66	36.12	5.82
Cynosuris cristatus	11.08	3.54	52.64	26.36	6.38
Dactylis glomerata	13.53	3.14	44.32	33.70	5.31
Dactylis, seeds ripe	23.08	1.56	26.53	43.32	5.51
Festuca duriuscula	12.10	3.34	40.43	38.71	5.42
Holcus lanatus	11.52	3.56	39.25	39.30	6.37
Hordeum pratense	11.17	2.30	46.68	31.67	6.18
Lolium perenne	11.85	3.17	42.24	35.20	7.54
Lolium Italicum	10.10	3.27	57.82	19.76	9.05
Phleum pratense	11.36	3.55	53.35	26.45	5.28
Poa annua	11.33	3.42	51.70	30.22	2.83
Poa pratensis	10.35	2.63	43.06	38.02	5.94
Poa trivialis	9 80	3.67	40.17	38.03	8.33

This table may be used as a basis for estimating the hay value of the several grasses, it being understood that hay, however dry, is never absolutely free from water, as these specimens were. The usual amount of water in well made

hay is about 16 per cent. A comparison of the relative values of these grasses in the hay and pasture state cannot but be interesting, and may be instructive. It must never be forgotten, however, that the presence or absence of a large amount of water in a grass is not always to be accepted as conclusive proof of its value, since the same species of grass grown on an upland meadow, and under irrigation, will differ in the amount of water which it contains quite as widely as any two species grown under the same conditions. Again, the amount of water found in the same grass will vary widely at different stages of growth, from the first shooting up of the leaves to the ripening of the seeds. This fact is strikingly illustrated in the common old field broom sedge, which, when young, is eaten quite greedily by some cattle, but when the stem begins to shoot, nothing will eat it. This table, therefore, like all the others, is to be used, not as a standard of absolute values, but as an approximation and guide in forming estimates.

The following table will be found useful, being a report to the Higland Society by Mr. Stirling, of Glenbervie:

Column I. contains the scientific names.

Column II. contains the common name.

Column III contains the average weight of the seed per bushel in pounds.

Column IV. contains the average number of seeds in one ounce.

Column V. shows, in inches, the depth of cover at which the greatest number of seeds sprouted.

Column VI. shows, in inches, the depth of cover at which only about half the number of seeds sprouted.

Column VII. shows, in inches, the least depth of cover at which none of the seeds sprouted.

SEE PRECEDING PAGE FOR EXPLANATION.

I.	II.	III.	IV.	V.	VI.	VII.
Agrostis stolonifera	Florin	13	500,000	0 to ¼	½ to ¾	1
Agrostis vulgaris	Red Top	12	425,000			
Arrhenatherum avenaceum	Tall meadow oat grass	7	21,000	⅓ to ¾	1½ to 1¾	4
Cynosurus cristatus	Crested dog's tail grass	26	28,000			
Dactylis glomerata	Orchard grass	12	40,000	0 to ¼	¾ to 1	2¼
Festuca duriuscula	Hard fescue grass	10	39,000	0 to ¼	¾ to 1	2¼
Festuca elatior	Tall fescue grass	14	20,500	0 to ¼	1 to 1¼	2¾
Festuca ovina	Sheeps' fescue	14	64,000	0 to ¼	¾ to 1	2
Festuca ovina tenuifolia		15	80,000			
Festuca pratensis loliacea		15	24,700			
Glyceria aquatica		18	58,000	¼ to ⅓	¾ to 1	2⅓
Glyceria fluitans	Common manna grass	15	33,000			
Holcus lanatus	Soft meadow grass	7	95,000	¼ to ½	¾ to 1	2⅓
Holcus mollis		6	85,000			
Lolium Italicum	Italian rye grass	15	27,000	0 to ¼	1 to 1¼	3¼
Lolium perenne	Rye grass or darnel	18 to 30	15,000	¼ to ⅓	1⅓ to 1¾	3⅓
Milium effusum		25	80,000	¼ to ⅓	1 to 1¼	2¾
Phalaris arudinacea		48	42,000			
Phleum pratense	Timothy	44	74,000	0 to ¼	¾ to 1	2
Poa nemoralis	Wood meadow grass	15	178,000			
Poa pratensis	Blue Grass	13	243,000			
Poa trivialis	Rough stalk meadow	15	217,000	0 to ¼	⅓ to ¾	1⅓
Trisetum flavescens		5⅓	118,000	0 to ¼	¾ to 1	2
Achillia millifolium		30	200,000	¼ to ⅓	⅓ to ¾	1⅓
Cichorium intybus (Chicory)		32	21,000			
Lotus corniculatus		62	28,000	0 to ¼	¼ to ½	1½
Lotus major		64	51,000			
Medicago lupulina		63	16,000	0 to ¼	¾ to 1	1½
Medicago sativa		60	12,600			
Onobrychis sativa		26	1,280	¾ to 1	2 to 2¼	4¼
Trifolium pratense	Clover	64	16,000	0 to ⅓	1¼ to 1⅓	2
Trifolium pratense perenne		64	16,000	0 to ⅓	1¼ to 1⅓	2
Trifolium repens	White clover	65	32,000	0 to ¼	⅓ to ¾	1½

Composition of the ash of agricultural plants and products, giving the average of all trustworthy analyses published up to August, 1865, by Prof. Emile Wolff, of the Royal Academy of Agriculture, at Hohemheim, Wirtemberg:

I—MEADOW HAY AND GRASSES.

No.	SUBSTANCE.	No. of Analyses.	Per ct. of Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chlorine.
1	Meadow hay	13	7.78	25.6	7.0	4.9	11.6	6.2	5.1	29.6	8.0
2	Young grass	1	9.32	56.2	1.8	2.8	10.7	10.5	4.0	10.3	2.0
3	Dead ripe hay	1	7.73	7.6	2.9	3.4	12.9	4.4	9.7	63.1	5.7
4	Rye grass in flower	4	7.10	24.9	4.2	2.1	7.5	7.8	3.8	39.6	5.4
5	Timothy	3	7.01	28.8	2.7	3.7	9.4	10.8	3.9	35.6	5.0
6	Other sweet grasses	39	7.27	33.0	1.8	2.6	5.5	7.8	4.4	37.6	4.1
7	Oats, heading out	6	9.46	41.7	4.4	3.5	7.0	8.3	3.4	27.9	4.4
8	Oats in flower	7	7.23	39.0	3.3	3.2	6.7	8.3	2.7	33.2	4.0
9	Barley, heading out	5	8.93	38.5	1.7	2.9	7.0	10.1	2.9	31.2	5.6
10	Barley in flower	5	7.04	26.2	0.6	3.1	6.0	9.8	2.9	48.0	3.5
11	Winter wheat, heading out	2	9.73	34.7	1.9	1.5	4.9	7.4	2.8	41.9	5.3
12	Winter wheat in flower	3	6.99	25.7	0.5	2.2	3.1	7.3	1.9	56.8	2.8
13	Winter rye, heading out	1	5.42	38.6	0.3	3.1	7.4	14.7	1.6	32.0	......
14	Green cereals, light	5	7.20	29.6	1.5	3.9	6.6	9.1	4.1	41.4	4.3
15	Green cereals, heavy	5	9.21	35.6	3.4	4.7	8.3	8.1	4.8	30.0	5.6
16	Hungarian millet, green, (*Panicum germ*)	2	7.23	37.4	......	8.0	10.8	5.4	3.6	29.1	6.4

II—CLOVER AND FODDER PLANTS.

No.	SUBSTANCE.	No. of Analyses.	Per ct. of Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chlorine.
17	Red clover	56	6.72	34.5	1.6	12.2	34.0	9.9	3.0	2.7	3.7
	a. 15-25 percentage potash	15	6.01	20.8	1,9	18.2	39.7	9.4	3.8	1.3	5.4
	b. 25-35 " "	23	6.74	29.8	1.6	11.8	35.6	10.6	3.0	2.7	2·9
	c. 35-50 " "	18	7.19	46.3	1.4	7.8	27.3	9.2	2.2	2.5	3.2
18	White clover	2	7,16	17.5	7.8	10.0	32 2	14.1	8.8	4.5	3.2
19	Lucern	7	7.14	25.3	1.1	5.8	48.0	8.5	6.1	2.0	1.9
20	Esparsette	2	5,39	39.4	1.7	5.8	32.2	10.4	3.3	4.0	3.0
21	Swedish clover	2	5.53	33.8	1.5	15.3	31.9	10.1	4.0	1.2	2.8
22	*Anthyllis vulneraria*	1	5,60	10.3	4.5	4.6	68.9	7.0	1.6	2,9	0.2
23	Green Vetches	2	8.74	42.1	2.9	6.8	26.3	12.8	3.7	1.8	3.1
24	Green pea, in flower	1	7.40	40.8	0.2	8.2	28.7	13.2	3.5	2.6	1.8
25	Green rape, young	5	8.97	32.3	3.8	4.5	23.1	8.7	16 3	3.2	7.6

Composition of fresh or air-dry agricultural products, giving the average quantity of water, sulphur, ash and ash-ingredients, in 1,000 parts of substance, by Prof. Wolff:

SUBSTANCE.	Water.	Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chlorine.	Sulphur
I.—HAY.											
Meadow Hay	144	66.6	17.1	4.7	3.3	7.7	4.1	3.4	19.7	5.3	1.7
Dead ripe hay	144	66.2	5.0	1.9	2.3	8.5	2.9	0.5	41.8	8.8	2.7
Red clover	160	56.5	19.5	0.9	6.9	19.2	5.6	1.7	1.5	2.1	2.
White clover	160	60 3	10.6	4.7	6.0	19.4	8.5	5.3	2.7	1.9	
Swedish clover	160	46.5	15.7	0.7	7.1	14.8	4.7	1.9	0.6	1.3	......
Lucern	160	60.0	15.2	0,7	3.5	28.8	5.1	3.7	1.2	1.1	2.6
Esparsette	160	45.3	17,9	0.8	2.6	14.9	4.7	1.5	1.8	1.4	......
Green vetches	160	73.4	30.9	2.1	5.0	19.3	9.4	2.7	1.3	2.3	1.5
Green oats	145	61.8	24.1	2,0	2.0	4.1	5.1	1.7	20.5	2.5	1.5
II.—GREEN FODDER.											
Meadow grass, in blossom	700	23.3	6.0	1.6	1.1	2.7	1.5	1.2	6.9	1.9	0.6
Young grass	800	20.7	11.6	0.4	0.6	2.2	2.2	0.8	2.1	0.4	0.4
Rye grass	700	21.3	5.3	0.9	0.5	1.6	1.7	0.8	8.4	1.1	0.7
Timothy	700	21.0	6.1	0.6	0.8	2.0	2.3	0.8	7.5	1.1	0.8
Other grasses	700	21.8	7.2	0.4	0.6	1·2	1.7	1.0	8.2	0.9	0.7
Oats, beginning to head	820	17.0	7.1	0.8	0.6	1.2	1.4	0.6	4.7	0.8	0.3
" in blossom	770	16.6	6.5	0.6	0.5	1.1	1.4	0.5	5.5	0.7	0.4
Barley, beginning to head	750	22,3	8.6	0.4	0.7	1.6	2.3	0.7	7.0	1.2	0.5
" in blossom	680	22.5	5.9	0.1	0.7	1.4	2.2	0.7	10.8	0.8	0.7
Wheat, beginning to head	770	22.4	7.8	0.4	0.3	1.1	1.7	0.4	9.4	1.2	0.3
" in blossom	690	21.7	5.6	0.1	0.5	0.7	1.6	0.4	12.3	0.6	0.5
Rye fodder	700	16.3	6.3	0.1	0.5	1.2	2.4	0.2	5.2	...	....
Hungarian millet	680	23.1	8.6	...	1.9	2.5	1.3	0.8	6.7	1.5	....
Red clover	800	13.4	4.6	0.2	1·6	4.6	1.3	0.4	0.4	0.5	0.5
White clover	810	13.6	2.4	1.1	1.4	4.4	2.0	1.2	0.6	0.4	0.6
Swedish clover	815	10.2	3.5	0.2	1.6	3.2	1.0	0.4	0.1	0.3	....
Lucern	753	17.6	4.5	0.2	1.0	8.5	1.5	1.1	0.4	0.3	0.8
Esparsette	785	11.6	4.6	0.2	0.7	3.7	1.2	0.4	0.5	0.3	....
Anthyllis vulneraria	780	12.3	1.3	0.5	0.6	8.5	0·9	0.2	0.4	...	....
Green vetches	820	15.7	6.6	0.5	1.1	4.1	2.0	0.6	0.3	0.5	0.3
" peas	815	13.7	5.6	...	1.1	3.9	1.8	0.5	0.4	0.2	....
" rape	850	13.5	4.4	0.6	0.6	3.1	1.2	2.2	0.4	1.0	0.6

Proximate composition of agricultural plants and products, giving the average quantities water, organic matter, ash, albuminoids, carbohydrates, etc., crude fibre, fat, etc., by Professors Wolff and Knop.*

SUBSTANCE.		Water.	Organic matter.†	Ash.	Albuminoids.	Carbohydrates, etc.‡	Crude fiber.§	Fat, etc.¶
HAY.								
Meadow hay, medium quality		14.3	79.5	6.2	8.2	41.3	30.0	2.0
Aftermath		14.3	79.2	6.5	9.5	45.7	24.0	2.4
Red clover, full blossom		16.7	77.1	6.2	13.4	29.9	35.8	3.2
" " ripe		16.7	77.7	5.6	9.4	20.3	48.0	2.0
White clover, full blossom		16.7	74.8	8.5	14.9	34.3	25.6	3.5
Swedish, or Alsike clover (*Trifolium hybridum*)		16.7	75.0	8.3	15.3	29.2	30.5	3.3
" clover, ripe		16.7	78.3	5.0	10.2	23.1	45.0	2.2
Lucern, young		16.7	74.6	8.7	19.7	32.9	22.0	3.3
" in blossom		16.7	76.9	6.4	14.4	22.5	40.0	2.5
Sand lucern, early blossom (*Medicago intermedia*)		16.7	77.2	6.1	15.2	26.9	35.1	3.0
Esparsette, in blossom		16.7	77.1	6.2	13.3	36.7	27.1	2.5
Incarnate clover " (*Trifollum incarnatum*)		16.7	76.1	7.2	12.2	30.1	33.8	3.0
Yellow " " (*Medicago lupulina*)		16.7	77.3	6.0	14.6	36.5	26.2	3.3
Vetches, in blossom		16.7	75.0	8.3	14.2	35.3	25.5	2.5
Peas " "		16.7	76.3	7.0	14.3	36.8	25.2	2.6
Field spurry, in blossom (*Spergula arvensis*)		16.7	73.8	9.5	12.0	39.8	22.0	3.2
" " after blossom		16.7	75.5	7.8	7.8	41.7	26.0	2.5
Serradella " " (*Ornithopus sativus*)		16.7	77.7	5.6	14.6	29.2	33.9	1.5
" before "		16.7	75.8	7.5	15.3	37.2	26.1	1.9
Italian rye grass (*Lolium Italicum*)	Cut in blossom.	14.3	77.9	7.8	8.7	51.4	16.9	2.8
Timothy (*Phleum pratense*)		14.3	81.2	4.5	9.7	48.8	22.7	3.0
Early meadow grass (*Poa annua*)		14.3	83.3	2.4	10.1	47.2	25.9	2.9
Crested dog's tail (*Cynosuras cristatus*)		14.3	80.2	5.5	9.5	48.0	22.6	2.8
Soft brome grass (*Bromus mollis*)		14.3	80.7	5.0	14.8	35.0	31.0	1.8
Orchard grass (*Dactylis glomerata*)		14.3	81.1	4.6	11.6	40.7	28.9	2.7
Barley grass (*Hordeum pratense*)		14.3	80.4	5.3	9.6	42.0	27.2	2.0
Meadow foxtail (*Alopecurus pratensis*)		14.3	79.9	6.7	10.6	39.5	29.0	2.5
Oat grass, French rye grass (*Arrhenatherum avenaceum*)		14.3	75.8	9.9	11.1	35.3	29.4	2.7
English rye grass (*Lolium perenne*)		14.3	79.2	6.5	10.2	38.9	30.2	2.7
Harter Schwingel (*Festuca?*)		14.3	81.0	4.7	10.4	37.5	33.2	2.9
Sweet-cented vernal grass (*Anthoxouthum odoratum*)		14.3	80.3	5.4	8.9	40.2	31.2	2.9
Velvet grass (*Holcus lanatus*)		14.3	80.2	5.5	9.9	36.7	33.6	3.1
Spear grass, Kentucky blue grass (*Poa pratensis*)		14.3	80.6	5.1	8.9	39.1	32.6	2.3
Rough meadow grass (*Poa trivialis*)		14.3	78.6	7.1	8.4	37.6	32.6	3.2
Yellow oat grass (*Avena flavescens*)		14.3	79.8	5.9	6.4	44.6	30.8	2.2
Quaking grass (*Brixa media*)		14.3	78.3	7.4	5.2	42.8	30.3	2.6
Average of all the grasses		14.3	79.9	5.8	9.5	41.7	28.7	2.6

* This table is, as regards water and ash, a repetition of last table, but includes the newer analyses of 1865-7. Therefore the averages of water and ash do not in all cases agree with those of the former tables. It gives besides, the proportions of nitrogenous and non-nitrogenous compounds, *i. e.*, albuminoids and carbohydrates, etc. It also states the averages of crude fibre and of fat, etc. The discussion of the data of this table belongs to the subjects of Food and Cattle-Feeding.

† *Organic matter* here signifies the combustible part of the plant.

‡ *Carbohydrates, etc.*, includes fat, starch, sugar, pectin, etc., all in fact of *Org. matter* except albuminoids and crude fiber.

§ *Crude fiber* is impure cellulous.

¶ *Fat, etc.*, is the ether-extract, and contains besides fat, wax, chlorophyll, and in some cases resins—*Professor Samuel W. Johnson, in "How Crops Grow."*

Proximate composition of agricultural plants and products:

SUBSTANCE.	Water.	Organic matter.	Ash.	Albuminoids.	Carbohydrates, etc.	Crude fibre.	Fat, etc.
GREEN FODDER.							
Grass, before blossom	75.0	22.9	2.1	3.0	12.9	7.0	0.8
" after "	69.0	29.0	2.0	2.5	15.0	11.5	0.7
Red clover before blossom	83.0	15.5	1.5	3.3	7.7	4.5	0.7
" full "	78.0	20.3	1.7	3.7	8.6	8.0	0.8
White " " "	80.5	17.5	2.0	3.5	8.0	6.0	0.8
Swedish clover, early blossom	85.0	13.5	1.5	3.3	5.7	4.5	0.6
" " full "	82.0	16.2	1.8	3.3	6.3	6.6	0.6
Lucern, very young	81.0	17.3	1.7	4.5	7.8	5.0	0.6
" in blossom	74.0	24.0	2.0	4.5	7.0	12.5	0.7
Sand lucern, early blossom	78.0	20.1	1.9	4.0	6.6	9.5	0.8
Esparsette in "	80.9	18.5	1.5	3.2	8.8	6.5	0.6
Incarnate clover in " (*Trifotium incarnatum*)	81.5	16.9	1.6	2.7	6.7	7.5	0.6
Yellow clover in " (*Medicago lupulina*)	80.0	18.5	1.5	3.5	9.0	6.0	0.8
Seradella " " (*Ornithopus sativus*)	80.0	18.7	1.3	3.6	7.0	8.1	0.4
Vetches " "	82.0	16.2	1.8	3.1	7.6	5.5	0.6
Peas " "	81.5	17.0	1.5	3.2	8.2	5.6	0.6
Oats, early blossom	81.0	17.6	1.4	2.3	8.8	6.5	0.5
Rye	72.9	25.5	1.6	3.3	14.9	7.3	0.9
Maize, late end August	84.3	14.6	1.1	0.9	8.7	5.0	0.5
" early "	82.2	16.7	1.1	1.1	10.9	4.7	0.5
Hungarian millet, in blossom, (*Panicum germanicum*)	65.6	32.0	2.4	5.9	15.0	11.5	1.5
Sorghum saccharatum	74.0	25.1	0.9	2.5	15.3	7.3	1.4
Sorghum vulgare	77.3	21.6	1.1	2.9	11.9	6.7	?
Field spurry in blossom	80.0	18.0	2.0	2.3	10.4	5.3	0.7

CHAPTER IV.

DESIRABLE QUALITY OF GRASSES—HOW TO ESTABLISH PASTURES AND MEADOWS — MAINTENANCE AND IMPROVEMENT OF MEADOWS — WHAT KIND OF MANURES TO USE.

Grasses, as they are to be cut for hay or fed off by stock, are called meadow grasses or pasture grasses. By their structure some grasses are fitted only for the meadow, while others are fitted only for the pasture; a few are suited to both uses. Grasses with tuberous roots are purely meadow grasses. It is the nature of such plants to store up in their bulbs one year the material of growth for the next. It requires therefore a certain time for maturing the bulbs, and they must not be interfered with when formed. Manifestly cattle cropping over a field would prevent the formation of bulbs, or, if already formed, would soon destroy them, either by tramping or biting off their crowns. Timothy is a type of this grass. For the meadow it is almost without a rival—for permanent pasture it is scarcely worth sowing. Again, among meadow grasses some are valued on account of the amount of nutritious seed they yield, as is the case with timothy, while others, as redtop or herds grass are principally valued for their forage.

A pasture grass needs the property of springing up rapidly after being bitten down and resisting the tramping of cattle. Blue grass is the best known type of the pasture grass.

A few grasses, if left to themselves, grow rank, form thick bunches or tussocks, and get hard and tough, but if sown along with other grasses that crowd them remain slender and tender. Such is orchard grass, which also submits to frequent and close cropping, and is therefore an excellent pasture, as well as good meadow grass.

Again, grasses are esteemed for the time when they begin to grow in spring and ripen their seed in summer. The grass that comes forward in spring when other green food is wanting is especially valuable in the pasture; nor is the grass that yields an early crop of hay less valuable for the meadow.

The amount and quality of the aftermath, or second crop of hay, is also an important item in estimating the economic value of any grass.

Furthermore, the value of any given grass to any particular farmer will depend upon its adaptability to his land. Some grasses thrive on low lands but will scarcely live on uplands, while others confine themselves to uplands entirely. Soils, and exposure too, have much to do with the success and value of different grasses. So that the farmer who comes to consider the subject of grasses, will find it no easy matter to select the best grasses for his farm. It will require no small degree of study and reflection.

As an aid to farmers desiring to lay down land to grass, a selected list of long-tried pasture and meadow grasses is given:

PASTURE GRASSES.

Kentucky blue grass	Poa pratensis
Wire grass	P. compressa
Spear grass	P. annua
Rough stalked meadow	P. trivialis
Orchard grass	Dactylis glomerata
Meadow fescue	Holcus lanatus
Meadow foxtail	Alopecurus pratensis
Sweet-scented vernal	Anthoxanthum odoratum
White clover	Trifolium repens

MEADOW GRASSES.

Orchard grass	Dactylis glomerata
Red clover	Trifolium pratense
Timothy	Phleum pratense
Hungarian grass	Panicum Germanicum

There are many other grasses included in most of the lists to be found in all the books from the time of Sinclair, and it may be that a better pasture or meadow can be made by adding them, but it will be quite enough gain for one generation if the farmers of Tennessee will put in the few given. A caution is needed in sowing meadows, not to sow clover or orchard grass with timothy, because they do not ripen with it. Clover and orchard grass, however, do admirably together, and if a small proportion of sweet vernal grass be mixed with them, they make a hay of the very finest quality. As a rule, however, red clover should not be sown in a permanent meadow, because by so doing one of its most valuable properties, viz., preparing the ground for other crops, is lost, and because, being a biennial, it is likely to run out on ground not already rich. It is doubtful if red clover should ever be introduced into a permanent pasture. White clover, however, may be so used in many localities, especially where milk cows are kept.

Though not exactly to the point of this paper, it may not be amiss to state that land too poor to carry a stand of red clover may be brought up by sowing it down in white clover and turning under the white clover after it has been well pastured. Peas are also a good crop for the same purpose. Rye is an excellent pioneer crop for red clover, when sown in August, whether pastured or turned under in March. One of the chief values of red clover itself is as a preparation for wheat. A good clover sod is better than a heavy coating of manure for the wheat crop. In like manner, land that is to be put down in permanent grass can be better manured at less cost by turning under a good clover sod than in any other way. Where this course has been followed, however, care should be taken not to apply mineral fertilizers to the grass, else the clover seeds that have been shattered into the soil may be brought forward so much as to take the grass.

On any but the richest soils the establishment of a first-

class pasture or meadow is the work of many years, and of much care and attention. On the best limestone soils, where the blue grass is indigenous, it is a comparatively easy matter to get a good turf, but, unfortunately, a large portion of Tennessee is not blessed with such soil, and for these regions preparation and care are needed. It is especially for such sections that these pages are written, though it cannot be denied that the pastures and meadows on the very richest of Tennessee lands would be all the better if the advice here given were followed.

It would perhaps be most convenient for the majority of farmers to begin rightly with pasture lands. A large deal of the woodland of the farmers of Tennessee may, with comparative ease, be converted into very good pastures, simply by clearing out the undergrowth, sowing down in good pasture grasses, and *depasturing closely with cattle.* In many woodlands all that is needed for a fair pasture is clearing up and putting on the cattle. The indigenous grass, if allowed a chance to grow, will make a passable pasture. But even the best of such land will be much benefitted by a generous seeding of improved grasses and a good top dressing of manure. In addition to clearing out the undergrowth, the leaves should be raked off, and if a heavy harrow be passed over the ground it will be all the better. The seeds may be sown just after the harrow and followed by a light brush harrow; or, they may be sown on the first snow which, in melting, will carry them into the ground evenly and to about the proper depth. Once the grass is set it needs only to be fed properly to improve. It may be slightly grazed, by young cattle, the first summer; *but on no account should sheep be allowed run on young grass.* It is a generally accepted notion, and doubtless a true one, that on old pastures sheep are a help, but they are certainly very destructive to young grass.

In addition to the woodland pastures, every farm needs other pastures that have been cultivated. The preparation

of these is similar in every way to the preparation for meadows. It should be borne in mind, however, that bottom lands that are at all inclined to be wet are unfitted for pastures. Wet or even moist land will pack under cattle. Since land once laid down in grass can never take the plow while the grass lives, all the necessary cultivation or plowing must be given it beforehand, and, since it is to be once for all, this preparation should be as thorough as possible. Thoroughly prepared land should be entirely free from standing water. The soil should be so loose and friable that the heaviest rain will not render it soggy, nor the longest drought make it crack. An easy and simple test of the presence of too much tightness in land is to dig a few holes, say two feet deep, and notice after a rain how long the water stands in them. If it stands for twelve hours after the rain has ceased, unless the rain has been of long continuance, say several days, then the land needs loosening. It is too tight—holds too much water. For this the best known remedy is under-draining. This is not only the most effectual but also the most profitable remedy, and will pay wherever properly applied. The next best thing, and the thing that should always be done, whether the land is under-drained or not, is subsoiling. This can be done as thoroughly with a properly made bull-tongue plow as with the best subsoiler ever patented. The bull-tongue only needs to be made long and narrow, and sent down as deep as it can be made to go in the track of the best turning plow to be had. After it has been thoroughly plowed, a good top dressing of air-slacked lime should be given, say 250 bushels to the acre. Then the ground should be well harrowed. It will pay to cross-harrow, to be followed by a generous top dressing of manure, then the seed put in. This last operation should be thoroughly well done. The common error among American farmers in sowing grass seed is the putting on too few seed, and of too small a variety. There are undoubtedly pastures in Kentucky

where one kind of grass, blue grass, is made to answer a most excellent purpose, but the favoring circumstances which render this course practicable do not occur in many other sections, and nowhere outside of the blue grass regions. Even on this favored soil there is good reason for believing that the addition of several other kindred grasses would add much to the best pastures. Be this as it may, there can be no doubt as to the very great advantage to be derived from a variety of grasses in other localities. One of the first things observed by Sinclair in his experiments was the fact that there is naturally a constant succession in the time of blooming of different grasses. As a result of this condition of things, it is practicable to make a turf which shall continue in good heart from early spring to late winter. By reference to the table on another page, the time of blooming of the various grasses may be learned.

Another most important point to be determined in seeding down land to pasture is the adaptability of the grass to the location and soil. It is by no means to be supposed that a grass that is rich and luxuriant in one place will be equally so in every place. The very reverse is more likely to be the case. Again, it is by no means the rankest grass that makes the finest pasture—on the contrary, the finest beef and the finest mutton are both grown on grass comparatively short though rich and nutritious. Indeed it is the experience of the best grass farmers that great fineness of grass is incompatible with great luxuriance.

The notion too commonly prevails that when once a farmer has put his grass in the ground his work is done—that for the future he must trust to Providence, or, more commonly, to luck. Nothing could be further from the truth. His work is by no means done. It is only begun. In the case of meadows and pastures, faith without works is of no avail. Providence never asks to be trusted, but demands to be obeyed. Luck is a myth—there is no such thing. Results good or bad flow naturally and inevitably

from wise attention to, or unwise neglect of the laws of nature. In the matter in hand these laws are few, simple and easily ascertained. Perhaps they may be embraced in two short sentences, viz: To preserve a good stand of grass it needs to be abundantly fed. Different grasses require different foods.

If we may judge from the practice that prevails almost universally in Tennessee, farmers do not seem to be aware that pastures or meadows ever need to be manured. If there is a farmer in the State who habitually spreads manure over his pastures or his meadows, he is a rare exception to his class. It cannot be that this neglect comes from ignorance of the fact that every hay crop and every season's grazing extracts from the land an enormous bulk of plant material.

It is difficult to conceive how any one can fail to see so large a fact. It must be, therefore, that the notion prevails because land laid down in grass does not wash away or run out so rapidly as land under the plow, that therefore it need not to be kept in heart. Such a notion is entirely erroneous. The roots of the natural grasses are almost entirely fibrous. They descend only a few inches below the surface. Of necessity their food must be obtained in a thin layer of top soil. There is no chance for the air with its warmth, or the rain with its moisture to penetrate it, and the ammonia of both air and water is almost entirely cut off from the soil. There is, therefore, no source left open to the soil whence it can renew the supply of plant food taken off annually, either as hay or depastured by stock. In the latter case some return is made in the droppings. This, however, is never entirely equal either in kind or quality to the materials removed from the soil. But the every-day experience of the farmer is of itself the best proof that can be made, if only he would think of it. Why do farmers say that their meadows have "run out," or that

their pastures are "run out?" Simply because they have failed to feed them. Because year after year they have taken off ton after ton of hay without returning a single pound of plant food.

The preparation of land for a meadow is so nearly the same as that given for a pasture that it need not be repeated. The grasses specially adapted to the meadow are, however, quite different from those given for the pasture. Timothy, which stands at the head of the meadow grasses, is altogether unfit for the pasture, because it will neither bear tramping nor close cropping.

There are, however, many most excellent grasses to be selected for the meadow. In making this selection it is of exceeding importance to note the time of flowering, and care should be taken not to have in the meadow, grasses that ripen at different times, for if this is allowed really good hay cannot be made. Part of the hay is obliged to be cut either too green or too ripe. It is always desirable to have more than one meadow, and so arranged that they shall ripen in succession. This point is readily gained by selecting for the different meadows, grasses that ripen in succession.

For convenience and as a help we give a list of the grasses that experience has proved to be well adapted to the pasture. These lists are given more as suggestions than as guides or recipes. After all, each farmer must exercise his own judgment as to what grasses are best suited to his purposes, and best adapted to his soils.

The labors of Professor Way and other chemists were chiefly of value in explaining certain facts long noted by observing farmers concerning the relations of the grasses and soils. Long before any attempt at chemical analysis of the soil or the grasses had been made, it was well known to the best farmers that certain grasses were admirably

suited to certain soils, but wholy unsuited to others. It was also well known, though by no means so generally, that certain manures stimulated the growth of certain grasses and seemed to retard the growth of others. Chemical analysis disclosed that the soils that were suited to different grasses were composed of different ingredients, or if containing the same ingredients, they were present in different proportions. Also analysis showed that the grasses that flourished on a given soil were composed largely of the plant food that characterized that soil, and on the other hand that a grass that ran out quickly on a given soil contained a large amount of some ingredient in which the soil was deficient.

From these facts it seems but an easy step to infer that certain manures might be relied on to stimulate the growth of certain grasses; yet simple and easy as the step seems it was not taken with anything like assurance until those distinguished experimenters, Lawes and Gilbert, of Rothamsted, England, demonstrated by a series of field experiments continued through several years, that the character of the herbage in different parts of any given pasture or meadow may be entirely changed by the continued and abundant use of different manures. The reports of these experiments were made to the Royal Agricultural Society of England, and are to be found in the journals of that society from 1858 to 1865. The general results of these experiments may be briefly summarized as follows:

I. *Mineral Manures*, (super-phosphate of lime, sulphate of soda, sulphate of magnesia), stimulated the growth of the *leguminous* plants, (clovers), but scarcely affected the natural grasses.

II. *Nitrogenous* manures, (guano and ammonical salts), stimulated the natural grasses and discouraged the leguminous herbage.

III. A judicious mixture of mineral and nitrogenous manures increased the growth of grasses far beyond the sum of increase attained by the two used separately.

IV. Farm-yard manure stimulated the growth of both the grasses and leguminous herbage, but chiefly the former.

V. A mixture of mineral manures, (consisting of 200 pounds of bone ash, 150 pounds sulphuric acid, 300 pounds sulphate of potash, 200 pounds sulphate of soda, 100 pounds sulphate of magnesia, and 400 pounds each of muriate and sulphate ammonia, exceeded in increase by more than a ton per acre the increase produced by 14 tons of farm-yard manure of good quality.

It may perhaps be useful to relate how these experiments were tried. A piece each of meadow and pasture of uniform quality and condition was laid off and a careful examination and record made of the kinds of herbage and their proportions. The lands were then laid off in plats and the several manures applied year after year. At the close of every growing season each plat was carefully examined and a record made of the proportions of the different plants present. Two of the plats were kept unmanured as standards of comparison. The hay cut from the meadow plats was carefully weighed and analyzed, so that the experiments not only show how much increase each manure gives in bulk, but also what plants it increases and how it influences the quality of the hay. These results render the experiments by far the most valuable yet made in grass culture. With the exception of the chemical analyses these experiments made be repeated by any intelligent farmer. It is only through such experiments that new facts may be learned or old notions put to the test. This is the kind of work waiting the educated farmers.

As a practical conclusions from their experiments, Messrs. Laws and Gilbert advise the farmers to apply a large

amount of barn-yard manure, in a well rotted state, every four or five years, and a small quantity of commercial manure every year, say in January or February. Under the most favorable circumstances, however, and with the best of treatment, the establishment of a really good turf is the work of years. But when once established it is a thoroughly safe and exceedingly profitable investment.

CHAPTER V.*

SHORT REVIEW OF THE LIFE-HISTORY OF PLANTS, AND THEIR CLASSIFICATION, WITH SPECIAL REFERENCE TO GRASSES AND FORAGE HERBS—CONTRIBUTED BY DR. GATTINGER.

Plants are living organic beings, deriving their origin unconditionally from other like beings (parentage), as detached particles of the same by fission, budding, or seed production, which, under the influence of light, heat and moisture, possess the faculty of growing and developing into bodies exactly like those from which they have been first detached. This growth they accomplish by attracting and taking within themselves simple elements or inorganic compounds from their surroundings, which, by their power of assimilation they convert into organic compounds or tissues like their own. At a certain period of their growth and development they become able to reproduce themselves, which is called their state of maturity, after which their cycles of life are either closed, and the parental plant decays—annual plants, or they repeat indefinitely that process of reproduction and individual growth—perennials.

This simple sketch of vegetable life is within the universal assemblage of individual plants, which we call the vegetable kingdom, carried out under a wonderful variety of forms and methods. The human intellect, in its endeavor to understand the meaning of this untold number of forms, has, since the dawn of civilization, attempted to group the like and the unlike until it in recent days succeeded in establishing a rational system of classification.

For this purpose it has been agreed upon, that the aggre-

gate of individuals, descending from one another and from common ancestors, and those which resemble them as strongly as they resemble one another, should be called *Species*.

Groups of similar or related species are called *Genera*.

Groups of genera similarly related as the above constitute *Families*.

The highest generalizations are denominated *Classes* and *Divisions*.

All these divisions have received special denominations, and the identity of an individual is recognized by the expression of the name of its generic and specific name, *e. g. viola odorata*, scented violet; *lilicum candidum*, white lily.

All plants, from the minute to the gigantic, simplest or wonderfully complex, whether aquatic, terrestrial or parisitic, in considering their method of propagation, can be grouped into two series:

Series I. Phænogamous, or flowering plants, which produce flowers and seeds, the latter containing a ready-formed embryo.

Series II. Cryptogamous, or flowerless plants, whose organs of reproduction are not flowers, but some more or less analagous apparatus, and which are propagated by spores or specialized cells.

Omitting the cryptogamous series, which has no representatives amongst our meadow and forage plants, except as occasional intruders and fearful enemies to their life and development, in which respect they will be hereafter shortly mentioned, and scrutinizing the structure of the Phænogamous series, we shall find that their growth or increase takes place either by an annual addition upon the periphery—*exogens*, "outside growers"—or the newly formed woody matter is intermingled with the old, or deposited towards the center, which becomes more and more occupied with the woody threads as the stem grows older, and the increase in diameter takes place by gradual distension of the whole; such plants are called *endogens*, or "inside growers."

The two great classes of Phænagamous plants, indicated by this difference of the stem, possess also a marked difference in the structure of their seeds. The embryo of all endogenous plants sprouts with only one cotyledon or seed leaf. Hence they are called Monocotyledonous plants. The embryo of the exogens bears a pair of cotyledons, hence exogens are also called Dicotyledonous plants.

The Monocotyledons, with a stately assembly of families, furnish us with the families of the Grasses (*gramineæ*) and the Sedge family (*Cyperaceæ*), while the Dicotyledons embrace several families, which constitute more or less valuable pasturage herbs, but the Leguminous or Pulse family is the most important one, and deserves especial attention.

It has been stated that Phænogamous plants possess visible organs of reproduction. When these organs are enclosed within envelopes for their protection, this envelope is called flower. The flower is called complete when the envelope consists of two circles of flowering leaves, the outer and lower one called the calyx, the interior and generally delicately colored one, the corolla. The parts or leaves forming the calyx are termed the sepals, the parts of the corolla—petals. The petals, however, are frequently absent when the flower is said to be apetalous, or petals and sepals both wanting, when the flower is called incomplete.

The essential organs of flowers are likewise of two kinds, and disposed in two circles, one including the other. The outer ones are called stamens. A stamen consists of a column or stalk called the filament, to the apex of which is attached a rounded case, called the anther, filled with a powdery substance called the pollen, which it at length discharges through one or more slits. The remaining seed-bearing organs which occupy the summit of the flower are termed the pistils. A pistil is distinguished into three parts, the ovary, the hollow portions at the base which contains the ovules or bodies destined to become seeds; the style or columnar prolongation of the apex of the ovary, and the

stigma, a portion of the surface of the style denuded of epidermis, often assuming a great diversity of appearance.

Flowers possessing both these essential organs are perfect (hermaphrodite or bi-sexual), although from absence of the floral envelopes they may be incomplete.

Whenever either of these essential organs is wanting or abortive in one flower of the same individual or species, and present on another, the flower is said to be diclinous or unisexual. The flower which has the stamen only is called the male or sterile flower, and the one with pistils only female or fertile flower.

In separated flowers the two kinds of blossoms may be borne either on different parts of the same individual, or upon entirely different individuals, the flowers in the first instance, like those of Indian corn or oak, are called monœcious (living in one house), or they are borne upon entirely different individuals, like hemp or sassafras, and then they are called diœcious (living in two houses). One is called the male plant, the other the female.

Sometimes both these conditions occur upon the same species, and plants with such flowers are called polygamous. In some flowers the floral envelopes are developed, while the pistils and stamens remain undeveloped, and are therefore said to be neutral.

In some grasses and other plants all parts of a flower are sometimes reduced to a mere rudiment.

The supremacy in the vegetable world, in regard to structure, is by no means so undisputed as in the animal, and several families are contesting for the prize.

The power of voluntary motion is one of the essential qualities of superiority of animal over vegetable life, and wherever an approach to such power of self-motion is observed, we concede such species of plants a higher rank in relation to their less gifted brethren.

The Leguminous family, which concerns us so much for agricultural reasons, and as a large shareholder in our mea-

dows and pastures, embraces within its ranks many a member capable of putting into motion certain parts of their bodies either as a response or reaction to external mechanical or chemical irritation, executing them with considerable dispatch and regularity. Or again, some others possess the faculty of giving gradual direction to some of their organs by which unmistakeable advantages are gained for the position, the growth or seed production of the individual.

In selecting one type of this family, and explaining its parts and functions, the characteristics of the Leguminous family, and along with it the process of fructification and seed production in all Phænogamous plants will be explained. Take the bean plant. The principal member of it is the axis, which rises into the air; erect, with one part, while the other is imbedded in the earth and forms the root.

The appendages of the stem are leaves, developed from the opposite sides of successive nodes, the parts between these nodes are called inter-nodes, which become shorter and shorter towards the summit of the stem, which ends in a terminal bud. Buds are also developed in the axils of the leaves, and some of them grow into branches which repeat the characters of the stem, but others, when the plant attains its full development, grow into stalks which support flowers, each of which consists of a calyx, a corolla, a staminal tube and a central pistil; the latter is terminated by a style, the free end of which is the stigma. The staminal tube ends in ten filaments, four of which are rather shorter than the rest, nine of them are grown together into a tube, one is free to its point of insertion. Such an arrangement has in botanical terminology been called "diadelphous," (dis—two aldephus—brother). The pistil is hollow, and within, along the ventral side, (the side turned towards the axis), is attached, by short stalks, a longitudinal series of minute bodies, the ovules. Each ovule consists of a central conical nucleus, invested by two coats, an outer and an inner. Opposite the summit of the nucleus these coats are

perforated by a canal, the micropyle, which leads down to the nucleus. The nucleus contains a sac—the embryo sac—in which certain cells, one of which is the embryo cell, and the rest the endosperm cells, are developed. A pollen grain deposited on the stigma sends out a thread-like prolongation, the pollen tube, which elongates, passes down the style, and eventually reaches the micropyle of an ovule. Traversing the micropyle, the end of the pollen tube penetrates the nucleus, and comes into close contact with the embryo sac. This is the process of impregnation, and the result of it is that the embryo cell divides, and gives rise to a cellular embryo. This becomes a minute bean plant, consisting of a *radicle* or primary root; of two relatively large primary leaves, the cotyledons; and a short stem, the plumule, on which rudimentary leaves soon appear. The cotyledons now increase in size, out of all proportion to the rest of the embryonic plant; and the cells of which they are composed become filled with starch and other nutritious matter, *legumin*). The nucleus and coats of the ovule grow to accommodate the enlarging embryo, but, at the same time, become merged into an envelope which constitutes the coat of the seed. The pistil enlarges and becomes the pod; this when it has attained its full size, dries and readily bursts along its edges, or decays, setting the seeds free. Each seed, when placed in proper conditions of warmth and moisture, then germinates. The cotyledons of the contained embryo swell, burst the seed coat, and becoming green, emerge as the fleshy *seed leaves*. The nutritious matters which they contain are absorbed by the plumule and radicle, the latter of which descends into the earth and becomes the root, while the former ascends and becomes the stem of the young bean plant.

The tissues which compose the body of the bean plant are bounded at the surface by a layer of epidermic cells, within which, rounded or polygonal cells make up the ground substance or parenchyma of the plant, extending to its very

centre in the younger parts of the stem and in the roots; while in the older parts of the stem the centre is occupied by a more or less considerable cavity, full of air. This cavity results from the central parenchyma becoming torn asunder after it has ceased to grow, by the enlargement of the peripheral parts of the stem. Nearer to the circumference than to the centre, lies a ring of woody and vascular tissue, which, in transverse sections, is seen to be broken up into wedge-shaped bundles, by narrow bands of parenchymatous tissue, which extend from the parenchyma within the circle of woody and vascular tissue (medulla or pith) to that which lies outside of it. Moreover, each bundle of woody and vascular tissue is divided into two parts, an outer and an inner, by a thin layer of small and very thin cells, termed the cambium layer. What lies outside this layer belongs to the bark; what lies inside it, to the wood and pith.

The cells composing the cambium retain their power of multiplication, and divide by septa parallel with the length of the stem, or root, as well as transverse to it. Thus new cells are continually being added, on the inner side of the cambium layer, to the thickness of the wood, and on the outer side of it, to the thickness of the bark; and the axis of the plant continually increases in diameter, so long as this process goes on. This is the developement of exogens.

The soft parts of plants as far as they are exposed to the light, and as far as their epidermis is transparent, are green colored. This green color results from the presence, immediately below the epidermic tissue, and imbedded in the parenchyma, of minute, soft granules, called chlorophyll or leaf green. These corpuscles, through the agency of light, have taken their origin in the "protoplasma," a complex chemical compound essentially produced by the union of a few chemical elements, oxygen, hydrogen, carbon, nitrogen, which the plant absorbes by its roots and leaves, together with some mineral substances from the surrounding earth

and atmosphere. These elements dissolved in water begin their circulation in the roots and leaves of the plant, and under the influence of light, air and heat, and by the contact with preformed protoplasm, they are gradually brought over into one or the other form of this wonderful substance. The instability of the juxtaposition of its molecules endow it with an internal and external mobility not possessed by any other body. It possesses the power to arrange and re-arrange the above elements and some others, when they come into contact with it, into organic compounds. Protoplasm is the basis of all life upon earth.

The chlorophyll once formed, induces the respiration of plants. The epidermis especially, or the leaves, which are the organs of this function, possess innumerable openings, stomata, through which the air passes, to be absorbed by the fluids in the tissues, and to give up to the chlorophyll its carbonic acid. Now the most important chemical process in the economy of the plant is effected, the carbonic acid is decomposed and carbon and oxygen are mutually set free. The carbon passing over into a new combination with hydrogen and oxygen to form cellulose—the general material of vegetable fabric of cell formation. The greatest part of the inhaled oxygen is returned again into the atmosphere. All the woody fibre now forming upon earth, and all the coal and coal oils are derived that way.

It is evident, that the nitrogenous and mineral constituents of plant food, absorbed by the roots from the soil have to pass from them through the stem to the leaves.

That some sort of circulation of fluids must take place in the body of a plant, therefore, appears to be certain, but the details of the process are by no means clear. There is evidence to show that the ascent of fluid from the root to the leaves takes place to a great extent through the elongated ducts and spiral vessels that make up, together with parenchymatous cellular tissue, the body of the plant,

and which not unfrequently open into one another by their applied ends, and by that way form very fine capillary tubes of considerable length.

The mechanism by which this ascent is effected is of two kinds; there is a pull from above and a push from below. The pull from above is the evaporation which takes place at the surface of the plant, and especially in the air-passages of the leaves, where the thin-walled cells of the parenchyma are surrounded on almost all sides with air, which communicates directly with the atmosphere through the stomates. The push from below is the absorptive action which takes place at the extremities of the rootlets, and which, for example, in a vine, before its leaves have grown in the spring, causes a rapid ascent of the fluid (sap) absorbed from the soil. A certain portion of the fluid thus pumped up from the roots to the surface of the plant doubtless exudes, laterally, through the walls of the vessels, and, passing from cell to cell, eventually reaches those which contain chlorophyll. The distribution of the compound containing nitrogen and carbon, whatever it may be, which is formed in the chlorophyll bearing cells, probably takes place by slow diffusion from cell to cell.

It also can hardly be doubted that all the living protoplasm of the plant undergoes slow oxydation, with evolution of carbonic acid, and that this process, alone, takes place in the deeper seated cells. The supply of oxygen needful for this purpose is sufficiently provided for, on the one hand, by the minute air-passages which are to be found between the cells in all parenchymatous tissues, and on the other, by the spiral vessels, which appear always to contain air under normal circumstances in the woody vascular bundles.

The replacement of the oxygen of the air thus absorbed, and the removal of the carbonic acid formed, will be sufficiently provided for by gaseous diffusion.

From what has been said, it results that, in an ordinary

plant, growing in damp earth and exposed to the sunshine, a current of fluid is setting from the root toward the surface exposed to the air, where its watery part is for the most part evaporated, while gaseous diffusion takes place in the contrary direction from the surface exposed to the air, through the air-passages and spiral vessels which extend from the stomates to the radicles; the balance of exchange being in favor of oxygen, in all the chlorophyll bearing parts of the plant, which are reached by the sunlight, and in favor of carbonic acid in its colorless and hidden regions. At night, the evaporation diminishing with the lowering of the temperature, the ascent of the liquid becomes very slow, or stops, and the balance of the exchange in the air-passages is entirely in favor of carbonic acid; even the chlorophyll bearing parts oxydizing, while no carbonic acid is decomposed.

In the foregoing has been given in plain and untechnical language approved facts, which, under proper guidance, every person of ordinary intelligence may be thought to study and to observe for himself. The general principle of respiration, nutrition and reproduction of plants are, after a century's scientific work, pretty well understood, although a great deal of detail is yet to be investigated.

Often, from impure motives, is science denounced as "speculation." The growth of the pollen tube, and its entrance into the ovule can be as clearly seen with the aid of a medium power of a microscope as the stomata and air-passages. That kind of speculation which is really to be feared lies within the boundaries of ignorance. For instance, one can often hear asserted that the rust in the wheat is caused by the iron present in the soil of the field. The Agricultural Department in one of its recent volumes has given to the farmers a very exact analysis of this distressing phenomenon. In this, like in ever so many instances, it is again proven that the greatest evils and plagues that affect man and his operations, take their roots in the dispersion

and endless multiplication of exceedingly minute agencies, that often bring the wealth of nations on the verge of ruin, like the phylloxera of the grape vine, the pebrine on the silk worm, and scarlet fever and diptheria amongst our children. And, one need not expect to successfully combat those enemies before the great mass of the people is able to partake and to assist in a scientific investigation.

To determine the differences between the various grasses requires careful study from even an advanced botanical student. The gramineæ spread over the whole globe, are a very numerous family, forming, in fact, one twenty-second part of all phaenogamous plants, and containing about 300 genera and 4000 species. Of these, 74 genera with 287 species belong to the flora of the United States east of the Mississippi, and as they unmber amongst them all cereals, they are unquestionably the most important part of the vegetable kingdom for the interest of mankind. The following description of the family characters is given according to Gray's Manual:

Grasses, with usually hollow stems (culms) closed at the joints, alternate two-ranked leaves, their sheaths split or open on the side opposite the blade; the hypogynous flowers imbricated with two-ranked glumes or bracts; the outer pair (glumes proper) subtending the spikelet of one or several flowers; the inner pair (paleæ or palets) enclosing each particular flower, which is usually furnished with two or three minute hypogynous scales (squamulæ.) Stamens one to six, commonly three; anthers versatile, two-celled, the cells distinct. Styles mostly two or two-parted; stigmas hairy or feathery. Ovary one-celled, one-ovuled, forming a seed-like grain (caryopsis) in fruit. Embryo small, on the outside and at the base of the floury albumen. Roots fibrous. Sheath of the leaves usually more or less extended above the base of the blade into a scarious appendage (ligule.) Spikelets panicled or spiked. Inner (upper) palet usually two-nerved or two-keeled, enclosed or partly covered by the outer (lower) palet. Grain sometimes free, sometimes permanently adherent to the palets.

For an easier understanding of the structure of the grass-flower and seed, and the technical terms used in describing

them, a few species are selected and analyzed, such as are known to everybody.

1. Timothy. First described properly by the Swedish botanist, Carolus Linnaeus. A type of grass inhabiting North and Middle Europe, and made up by fourteen different forms, resembling one another so closely that they suggest to the observer a close relationship. To the aggregate Linnaeus applied the name Phleum. To one particular phleum that shows a predilection for pasture lands, he gave the specific name "pratense." Meadow Cats-tail or Timothy grass. It is a botanical practice to put after the name of the plant also the name of the botanist who first discovered it. Therefore, Phleum pratense, L.

Select a flowering specimen from the meadows, but one from the haystack may do as well. It is tall; (not branching laterally.) The flowering or top end is called "inflorescence." The spike is cylindrical and tolerably long, therefore an elongated spike; it is also dense and harsh. It is terminal and solitary, sometimes spikes are terminal, spreading and numerous, like in the Crab grass, digitate like in the Bermuda or barn-yard grass. They are lateral sometimes, sessile or peduncled. If arranged shortening toward the apex like the tassel of the Indian corn, this is called a pyramidal raceme. If instead of shortening toward the apex they are of about equal length, arranged around their rachis like in that delicate reddish grass by some called "old man's beard," that abounds late in the season in garden plots and corn fields, (Leptochloa mucronata) then we say the spikes are racemed.

The manner in which the single flowers, spikelets, are arranged along the spike is also very different.

In this species the spikelets are closely clustered in glomerules of 3–4 nearly sessile, densely joining one another attached to the rachis or main axis of inflorescence. In the meadow Fox-tail (Alopecurus pratensis) which greatly resembles

the Timothy, 3–4 spikelets are similarly arranged to a consert-ed cylindrical spike. But if these single clusters are more or less distant from another, like in the Sweet Vernal grass (Anthoxantum odoratum) it is said to be panicled-spiked. The barley bears a bilateral spike, spikelets in threes on each side. Hordeum hexastichum. In the Crab grass (Digitaria or Panicum sanguinale) the spikelets are arranged to one side of the rachis; the rachis may also be feathered on the back like in the related genus Paspalum. In the barn-yard grass the spikelets are imbricated (like the shingles on a roof) on a one-sided spike.

To analyze so small an object as the spikelet of the Timothy, or other yet more minute and delicate species, some care and patience are required.

The spikelet should be moistened first with a little water, after being placed upon a slip of glass, then the parts spread in a manner to expose the interior structure. The moistening prevents the flying away of the tiny membranes when they are dissected or distended with a fine knife or a pair of sewing needles. A lens to magnify the object is indispensable.

First two pairs of membranaceous leaflets are conspicuous. The lowest pair is called "glumes." They are opposite one another, but not exactly upon one and the same level. There is always an upper glume and a lower glume, and the observance of their mutual relations is of great importance. Sometimes they are nearly of one size, like in this instance, but generally one is larger, often out of all proportion, or either is minute, abortive or wanting, awned or variously shaped, or represented by a bristle-like organ called an awn. (Beard.) They are boat-shaped (carinate), ciliate on the back (beset with short, bristly hairs), pointed and tipped with a short bristle. Glumes serve as the common involucre for the upper and interior part or parts of the spikelet.

The upper or inner pair of leaflets or palets, (paleæ) is here only half the size of the former, truncate (the apex cut off) and include the ovary with two distinct styles terminated by feathery stigmas. From the base of the ovary ascend three stamens with thread-like filaments, versatile bilocular and comparatively large anthers.

2. Blue grass—*Poa pratensis.* L. Inflorescence *a panicle.* It will be remembered that above the tassel of Indian corn has been designated a pyramidal raceme; *i.e.* from the rachis or flower-bearing prolongation of the culm radiate secondary axis, pyramidally decreasing toward the apex. Those lateral axes again and often redivided constitute the panicle. This panicle is short pyramidal. In Poa compressa (wire grass) dense and narrow, in Orchard grass clustered and dense; Oat (avena sativa) is also panicled. Panicle at the time of fructification open and spreading at length drooping. Widely and loosely is termed diffuse, erect if the branches point upward, contracted if the branches are drawn close to the rachis, which often is the case after the flowering period.

The spikelets are ovate lanceolate ovate, crowded, and most of them almost sessile on the branches. Each spikelet consists of a pair of glumes shorter than the flowers, of which there are three to five; the uppermost flower remains small and undeveloped. (Timothy we have seen to contain in each spikelet only one flower.)

Lower palet stouter in structure than the npper one, membranaceo-herbaceous, with a delicate scarious margin, compressed-keeled, pointless, five-nerved, (the intermediate nerves more obscure or obsolete) hairy at the margin and keel; upper palet very delicate, two-toothed at the apex. Stamens two to three, stigmas plumose.

The presence or absence, number and condition of the nerves (vascular bundles) in the glumes and paleæ are of the greatest importance in the analysis of grasses, for not only

the distinction of species, but even of genera is often determined thereby.

A nerve often extends over the lamina of the glume or palet, either at the apex, or underneath, from the dorsal or keel-nerve. If this extension is small and delicate, it is named a bristle or bristly apex, if stout and lengthy, an *awn* or beard.

3. The common Oat. *Avena sativa.* L. Panicle large, simple, lax (spikelets remote). Spikelets two-flowered on capillary peduncles. Peduncles and branches rough downward. (Roughness felt by motion of the fingers downward.

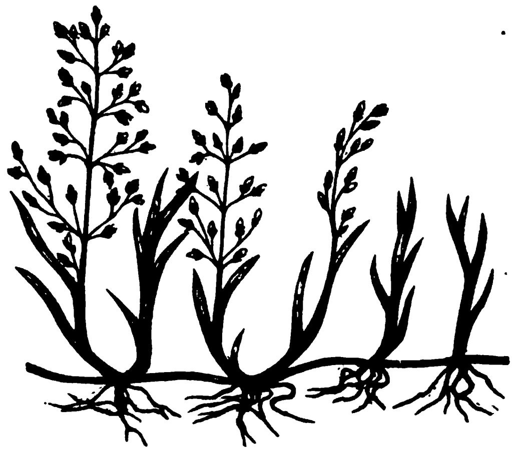
Glumes larger than the flowers, many-nerved, (eight to ten) thin membranaceous, awnless, persistent. (The glumes holding fast to their pedicels after the grain has fallen off.) Lower palet herbaceous, rounded and awned on the back, above the base, at the point almost bicuspidate; the upper one bicarinate, awnless. Bicarinate means presenting the form of a Greek omega or transverse section. Awn twisted, geniculate (bent with an angle) one, to one and a half inches long.

Stamina three, stigma, two plumose, palets investing the long, slightly tufted caryopsis, which is internally marked by a longitudinal furrow, hairy at the point.

The seed of grasses (coryopsis) is either free, dropping out from the palets like in Sporobolus and Diarrhena, or may be easily detached from the same like in the Wheat. At other times it is invested (firmly wrapped up in) one or both paleæ, like in Oat, or firmly connected with adhesions, like in the Barley.

A significant feature in the comparison of grasses affords also the Ligule (see above) whether it be truncate, acute, smooth, hairy, bearded, papillary, etc. Characters are also derived from the root, from the nodes, mode of ramification by the branching of the culms.

The root is annual, perennial, creeping, stoloniferous, fibrous. Culms solitary, in tufts, recumbent, ascending, smooth or rough, the nodes are sometimes bearded, in Herds grass (Agrostis vulgaris) from the lowest nodes, bulb-like intumescences. A creeping root is in fact a subteraneous stem. See fig.



CHAPTER VI.*

HOW TO TELL A GRASS—TABLE OF GRASSES.

As before stated, it is deemed necessary to speak only of those grasses indigenous to or growing in Tennessee. It will be endeavored to make the reader well acquainted with each species, and this will not be difficult if ordinary attention is paid to the directions. In speaking of each grass, both the common name and the botanic will be given. The botanic names will be enclosed in brackets, and the first will denote the genus and the second the species to which the grass belongs; for instance, blue-grass (Poa-pratensis), here Poa is the genus, and pratensis the species to which it belongs. If farmers would make it their business to inspect and classify all strange grasses that may fall under their observation, a state of intelligent inquiry would be aroused that would greatly redound to the interest of agriculture. For the benefit of such, a table is hereby appended, so that any one may analyze grasses and locate them. But little practice will be necessary to familiarize the student with the rules.

Let the flowers of the grass be first examined. If but one is found in each spikelet, refer to No. 2, the left hand column, and then examine and see if they are arranged in panicles or spikes; if the former, then refer to No. 3 of the left hand column, and see whether or not they are awned. If awned, refer to No. 4, if without awns, to No. 12 of the left hand column. If unawned, and having two glumes, refer to 13, and so on. If without glumes and aquatic, it is a Zizania or wild rice. If in the first examination the spikelets are found to have two or more flowers, refer to 26 of the left hand colnmn, and see whether the inflorescence

is in panicles or spikes. If the former, refer to 27 of the left hand column. If the latter, in spikes, refer to 39, and then see whether the spikelets are two-rowed, or one-sided. If the latter, refer to 45, and see whether the spikes are digitate and the spikelets in two rows. If they are, refer it to the genus Eleusine.

For convenience of reference a glossary is attached to this work.

ANALYTICAL TABLE.

1	Spikelet with but one flower	2
1	Spikelet with two or more flowers	26
2	Flowers arranged in panicles	3
2	Flowers in spikes	16
3	With awns or beards	4
3	Without awns or beards	12
4	Glumes large	5
4	Glumes minute, unequal, one hardly seen	11
4	Glumes none, grass aquatic	2 Zizania
5	Without abortive rudiments	6
5	With an abortive rudiment of a second flower	52 Holcus
6	Paleæ two	7
6	Paleæ three, upper awned, flowers polygamus	66 Sorghum
7	Paleæ, with one awn	8
7	Lower paleæ with three twisted awns	15 Aristida
8	Paleæ cartilaginous or gristly	9
8	Paleæ herbaceous	10
8	Paleæ membranaceous, panicle open	7 Agrostis
8	Paleæ membranaceous, panicle contracted	8 Polypogon
9	Flowers sessile or joined to stem at base	13 Oryzopsis
9	Flowers stipitate, fruit black	14 Stipa
10	Flowers naked, with one stamen	9 Cinna
10	Flowers hairy, stamens three	12 Calamagrostis
11	Stamens three	10 Muhlenbergia
11	Stamens two	11 Brachyelytrum
12	Glumes two	13
12	Glumes none, leaves rough from the end backwards	1 Leersia
13	Paleæ membranaceous	14
13	Paleæ leathery, spikelets all cauline	56 Millium
13	Paleæ leathery, fertile spikelet radical	57 Amphicarpon
14	Fruit coated or covered with a husk	15
14	Fruit naked	6 Sporobolus

15 Flowers stalked..7 Agrostis
15 Flowers sessile..5 Vilfa
16 Flowers awned...17
16 Flowers without awns.......... 22
17 Spikes solitary..18
17 Spikes many, awnless, unilateral, paleæ cartilaginous...59 Panicum
17 Spikelets two, fertile...............................63 Erianthus
17 Spikes two, polygamous, sterile, flowers bearded....64 Andropogon
18 Spikes simple or nearly so.......................................19
18 Spikes paniculate, or lobed......................................21
19 Involucre none.............................. 20
19 Involucre of two or more bristles.......................60 Setaria
19 Involucre burr-like................ ... .61 Cenchrus
20 Paleæ with awns one to three times their length......3 Alopecurus
20 Paleæ with awns five times their length..............44 Hordeum
21 Both glumes and paleæ awned................ ...10 Muhlenbergia
21 Glumes awnless, single paleæ awned.... ......54 Anthoxanthum
21 Paleæ two, lateral flowers staminate,...............53 Hierochloa
22 Flowers perfect or polygamous....................................23
22 Spikes monœcious..25
23 Spikes one-sided..24
23 Spikes cylindrical, solitary terminal....................4 Phleum
24 Spikes two or more, spikelets suborbicular...........58 Paspalum
24 Spikes digitate or verticillate, linear.... ....59 Panicum
24 Spikes pedunculate, in a two-sided panicle.............16 Spartina
24 Spikes sessile, in a one-sided panicle.................41 Lepturus
25 Spikes all terminal, sterile above, fertile at base......62 Tripsacum
25 Fertile spikes lateral, sterile ones terminal panicled.........66 Zea
26 Inflorescence in panicles.... 27
26 Inflorescence in spikes 39
27 Flowers awned............... 28
27 Flowers without awns...................................... 33
28 Lower paleæ awned on the back.....................................29
28 Lower paleæ awned on the apex 32
29 Awn near the base of the paleæ.....................................30
29 Awn near the apex of the paleæ.....................................31
30 Apex bifid, awn bent..................................50 Avena
30 Apex bifid, awn bent, lower flower sterile........51 Arrhenatherum
30 Apex multifid.......... ....47 Aira
31 Paleæ with two bristly teeth...........................49 Trisetum
31 Paleæ bifid............... ....37 Bromus
32 Lower paleæ rounded, obtuse................................35 Briza
32 Lower paleæ entire, pointed, fruit coated..... ....36 Festuca
32 Awn between two teeth, twisted.....................48 Danthonia

33 Terminal flower perfect.................................34
33 Terminal flower abo tive, or a mere pedical......... 36
34 Paleæ entire, outer one mucronate........................ 35
34 Glumes unequal, like the lower abortive paleæ ....59 Panicum
34 Glumes equal, longer than the paleæ.................55 Phalaris
34 Lower paleæ truncate, mucronate, inner bifid............38 Uniola
34 Flowers silky-bearded on the rachis................39 Phragmites
34 Spikelets terete, paleæ seven-nerved..................31 Glyceria
34 Spikelets two to six, five nerved.........................33 Poa
34 Spikelets two to twenty, three nerved............. .34 Eragrostis
34 Spikelets flat, lower paleæ laterally compressed.....32 Bryzopyrum
35 Scales two, styles two.......................... ..36 Festuca
35 Scales and styles three..........................40 Arundinaria
36 Panicle contracted............ ... .37
36 Panicle large, diffuse............................30 Melica
37 Lower palea one-pointed or mucronate............ 38
37 Lower palea pointless............................29 Eatonia
37 Lower palea three-cleft.........................24 Tricuspis
37 Lower palea awnless................ .. ..25 Danthonia
38 Stamens three............................. ....28 Koehleria
38 Stamens two...................................26 Diarrhena
39 Spikelets two ranked........ 37
39 Spikelets unilateral......................................43
40 Glumes broad...41
40 Glumes subulate..42
40 Glumes none..............................46 Gymnostichum
41 Glumes two, in the upper spikelet only.... ....42 Lolium
41 Glumes two, in each spikelet......................43 Triticum
42 Glumes collateral, spikelets in twos or more......... ...46 Elymus
42 Glumes opposite, spikelets solitary................. .....45 Secale
43 One perfect among several neutral ones...............17 Ctenium
43 One perfect flower below several neutral ones.................44
43 Spikelets conglomerate or paniculate................27 Dactylis
43 Spikelets with more than one perfect flower....... 45
44 Spikelets dense.........................,.........18 Bouteloua
44 Spikes filiform, racemed......................19 Gymnopogon
44 Spikes slender, digitate..........................20 Cynodon
45 Spikes digitate, glumes and palea awnless, blunt......22 Eleusine
45 Spikes racemed, slender........................23 Leptochloa

The grasses which we purpose to describe in the following pages, are named in the following list. It is intended to

make the article on each grass final, as to that species, and then a few observations will be given on the adaptability of the different soils to each genus of grasses. The list is far more numerous than here given. The others are confined either to the sea coast, salt marshes, or to points of altitude far higher than is attained by any lands within our State bouudaries:

TABLE 1—List of True Grasses.

COMMON NAMES.	BOTANIC NAME.	TIME OF BLOOMING.	PLACE OF GROWTH.
Rice grass	Leersia oryzoides	August	Low wet places.
White grass	Leersia Virginica	August	Damp woods.
Meadow Fox Tail	Alopecurus pratense	May	Fields and pastures.
Floating Fox Tail	Alopecurus geniculatus	May and June	Wet meadows, ditches.
Timothy	Phleum pratense	June and July	Fields and pastures.
Hidden-flowered Vilfa	Vilfa vaginæflora	September	Sandy and gravelly plains.
Rush Drop Seed	Sporobulus junceus	August	Dry soils.
Late drop Seed	Sporobulus serotinus	September	Wet sands.
Brown Bent	Agrostis canina	June and July	Fields and pastures.
Tickle grass	Agrostis scabra	June and July	Old dry fields.
Red Top	Agrostis vulgaris	July	Fields and pastures.
Fiorin	Agrostis stolonifera	July	Moist meadows.
Wood-reed grass	Cinna arundinacea	July and August	Shady swamp.
Clustering Muhlenberger	Muhlenbergia glomerata	August	Swamps.
Mexican Muhlenberger	Muhlenbergia Mexicana	August	Low grounds.
Sylvan Muhlenberger	Muhlenbergia sylvatica	August and September	Rocky woods.
Nimble Will	Muhlenbergia diffusa	August and September	Dry hills and woods.
Hair grass	Muhlenbergia capillaris	August	Sandy soils.
Awned Brachyelytrum	Brachyelytrum aristatum	June	Rocky woods.
Black-oat grass	Stipa avenacea	July	Dry sandy woods.
Poverty grass	Aristida dichotoma	September	Sandy pine barrens.
Slender three-awned grass	Aristida gracilis	September	Sandy fields.
Hairy Muskit	Bouteloua curtipendula	July and September	Stiff soil.
Short-leaved Beard grass	Gymnopogon brevifolium	August	Sandy soils.
Bermuda grass	Cynodon dactylon	July	Light soils.

TABLE 1—List of True Grasses—Continued.

COMMON NOME	BOTANIC NAME.	TIME OF BLOOMING.	PLACE OF GROWTH.
Egyptian grass	Dactyloctenium Ægypticum	July	Fields and yards.
Crab grass	Panicum sanguinale	June	Fields, yards.
Pointed slender grass	Leptochloa mucronata	August	Fields.
Tall Red-top	Tricuspis seslerioides	August	Sandy fields.
Twin grass	Diarrhena Americana	August	Moist shades.
Orchard grass	Dactylis glomerata	June	Fields and pastures.
Pennsylvania Eatonia	Eatonia Pennsylvanica	June	Moist woods.
Melic grass	Melica mutica	June	Fields.
Rattlesnake grass	Glyceria Canadensis	July	Wet bogs.
Pale Manna grass	Glyceria pallida	July	Shallow water.
Common Manna grass	Glyceria fluitans	June	Muddy ditches.
Annual Spear grass	Poa annua	April to October	Fields and pastures.
Wood Meadow grass	Poa nemoralis	June	Fields and pastures.
Rough-stalk Meadow	Poa trivialis	July	Fields and pastures.
June grass	Poa pratensis	June and July	Fields and pastures.
Blue grass	Poa compressa	July and August	Dry roadsides, pastures.
Creeping Meadow	Eragrostis reptans	July and August	Sandy river banks.
Strong-scented Meadow	Eragrostis poæoides	August and September	Sandy fields.
Pungent Meadow	Eragrostis megastachya	August	Sandy fields.
Slender Meadow	Eragrostis pilosa	August	Sandy gravelly places.
Southern Eragrostis	Eragrostis Purshii	July	Sterile plains.
Branching Spear grass	Eragrostis tenuis	August to October	Sterile plains.
Hair panicled Meadow grass	Eragrostis capillaris	August and September	Sandy plains.
Meadow Cone grass	Eragrostis pectinacea	August and September	Sandy plains.
Quaking grass	Briza media	June	Pastures.

TABLE 1—*List of True Grasses—Continued.*

COMMON NAME.	BOTANIC NAME.	TIME OF BLOOMING.	PLACE OF GROWTH.
Small Fescue grass	Festuca tenella	July	Dry sterile soils.
Sheep's Fescue	Festuca ovina	June	High pastures and hills.
Tall Fescue grass	Festuca elatior	June and July	Fields and pastures.
Willard's Brome or Cheat	Bromus secalinus	July	Fields and pastures.
Smooth Brome grass	Bromus racemosus	June	Grain fields.
Soft Chess	Bromus mollis	June	Fields and pastures.
Wild Chess	Bromus Kalmii	June and July	Dry open woods.
Meadow Brome	Bromus pratensis	July	Dry arid pastures.
Broad-leaved Spike grass	Uniola latifolia	August	Shaded fields.
Common Reed grass	Pragmites communis	September	Edges of ponds and swamps.
Cane grass	Arundinaria macrosperma	April	Rich soils.
Italian Rye grass	Lolium Italicum	June	Fields and pastures.
Many-flowered Darnell	Lolium multiflorum	June and July	Fields and pastures.
Couch or Twitch grass	Triticum repens	June and July	Fields and pastures.
Bearded Wheat grass	Triticum caninum	July	Woody banks.
Barley grass	Hordeum pusillum	May	Brackish soils.
Two-rowed Barley	Hordeum distichum	June	Fields.
Four-rowed Barley	Hordeum vulgare	June	Fields.
Rye	Secale cereale	June	Fields.
Lyme grass	Elymus Virginicus	August	River banks.
Canadian Lyme grass	Elymus Canadensis	August	River banks.
Slender Hairy Lyme	Elymus striatus	July	River banks.
Soft Lyme grass	Elymus mollis	July	Moist soils.
Bottle Brush grass	Gymnostichum Hystrix	July	Moist rocky woods.
Wood Hair grass	Aira flexuosa	June	Dry rocky woods.

TABLE 1—*List of True Grasses—Continued*

COMMON NAME.	BOTANIC NAME.	TIME OF BLOOMING.	PLACE OF GROWTH.
Tufted hair grass	Aira cæspitosa	June and July	Marshy wet bottoms.
Wild-oat grass	Danthonia spicata	June	Dry pastures.
Early Wild Oat	Avena præcox	June	Sandy soils.
Common Oat	Avena sativa	July	Cultivated fields.
Tall Meadow Oat grass	Arrhenatherum avenaceum	May and June	Fields and pastures.
Common Canary grass	Phalaris Canariensis	July and August	Gardens.
Double bearing Millet	Milium Purshii	September	Moist pine barrens.
Smooth Erect Paspalum	Paspalum læve	August	Moist meadows.
Joint Grass	Paspalum distichum	July and August	Wet fields.
Finger-shaped Paspalum	Paspalum digitaria	July and August	Moist grounds.
Slender Crab grass	Panicum filiforme	August	Dry sands.
Smooth Crab grass	Panicum glabrum	August and September	Fields, waste places.
Finger grass	Panicum sanguinale	August to October	Neglected fields.
Agrostis-like Panic	Panicum agrostoides	July and August	Wet meadows on rivers.
Double-headed Panic	Panicum anceps	August	Wet pine Barrens.
Prolific Panic grass	Panicum proliferum	July and August	Brackish marshes.
Hair Stalk Panic	Panicum capillare	August and September	....
Autumn Panic	Panicum autumnale	....	Sand hills.
Bitter Panic	Panicum amarum	August to September	Sandy banks.
Tall Smooth Panic	Panicum virgatum	August	Moist, sandy soils.
Broad-leaved Panic	Panicum latifolium	June and July	Damp thickets.
Hidden Flower Panic	Panicum clandestinum	July	Moist thickets.
Millet	Panicum miliaceum	June	Cultivated fields.
Few-flowered Panic	Panicum pauciflorum	June and July	Wet soils.
Polymorphous Panic	Panicum dichotomum	June to ugust	Moist fields.

TABLE 1—List of True Grasses—Continued

COMMON NAME.	BOTANIC NAME.	TIME OF BLOOMING.	PLACE OF GROWTH.
Hungarian grass	Panicum Germanicum		Cultivated fields.
Barn grass	Panicum crus-galli	August September	Rich cultivated fields.
Bristly Fox Tail	Setaria verticillata	August	About farm yards.
Bottle grass	Setaria glauca	July	Fields and barn-yards.
Green Fox Tail	Setaria viridis	June	Cultivated fields.
Bengal Grass	Setaria Italica	June	Fields.
Gama grass	Tripsacum dactyloides	August	Moist places on river.
Wooly Beard grass	Erianthus alopecuriodes	September	Moist pine barrens.
Short-beard Erianthus	Erianthus brevibarbis	August	Low grounds.
Froked Spike	Andropogon fureatus	September	Sterile rocky hills.
Purple Wood grass	Andropogan scoparius	July to September	Sterile sandy plains.
Silver Beard grass	Andropogan argenteus	September	Barren soils.
Virginian Beard grass	Andropogon Virginicus	September	Sandy soils.
Cluster-flowered Beard grass	Andropogon macrurus		Low grounds.
Indian grass	Sorghum nutans	August	Dry soils.
Dhurra Corn	Sorghum vulgare	July	Fields.
Broom Corn	Sorghum saccharatum	July	Fields.
Chinese Sugar Cane	Sorghum nigrum	July	Fields.
Chocolate corn	Sorghum bicolor	August	Fields.
Indian Corn	Zea Mays	July	Fields.
Flexible Hair grass	Aira flexuosa		Woods and pasture.
Perennial Agrostis	Agrostis perennis		Mountains
Compressed Danthonia	Danthonia compressa		Mountains.
Ciliated Brome	Bromus ciliatus		Old fields.
Slim Spike grass	Uniola gracelis	July	Mountain Limestone.

MEADOW GRASSES.

PART II.

In Part II, we shall treat of the Meadow Grasses, in the order named below:

Timothy—Red-Top or Herds Grass—Tall Red-Top grass—Orchard grass—Wood Meadow grass—Rough-stalk Meadow grass—Willard's Brome or Chess—English Rye grass—Italian Rye grass—Many-flowered Darnell—Crab or Crop grass—Millet—Hungarian grass—Barn grass—Bengal grass—Gama grass—Egyptian grass—Meadow Oat grass—Means, Johnson or Egyptian grass—Red Clover—Alsike or Swedish Clover—Sapling Clover—Crimson Clover—Alfalfa or Lucerne—Japan Clover—Esparsette or Sainfoin—Vetch.

CHAPTER VII.

Timothy—Herds Grass or Red-top.

TIMOTHY—(*Phleum Pratense*).

Spikes cylindrical or elongated, glumes hairy on the back, tipped with a bristle less than half their length; leaves long, flat, rough, with long sheaths; root perennial, on moist soils fibrous, on dry ones bulbous, mostly bulbous.

This grass is known in New England as Herds grass, from a Mr. Herd, who found it growing wild in New Hampshire, and introduced it into cultivation. Further south,

however, this name is only applied to Red-top, or *Agrostis vulgaris.*

Mr. Timothy Hanson carried it from New York to Carolina, and from him it is known as timothy grass.

There is much dispute as to its parentage, some claiming it as indigenous to the United States, while many others, among them Dr. Gray, give it an European origin. It is of little consequence where it sprang from, it stands confessedly at the head of all meadow grasses, not only in the amount of its yield, but in its superiority as a nutritious food for stock. It is eaten with more avidity than any other perennial grass, although it has a very coarse, rough stem, and less fodder than many others.

Its leaves are abundant near the ground, but those on the stalk are comparatively few. Like most other meadow grasses it attains its greatest value as a food before the seeds are ripe. The latter are very abundant and highly nutritious. From ten to thirty bushels are made on good land.

It ripens late, and consequently favors the farmer very much, as he is able to save his wheat before cutting and curing his hay. It was a common custom at one time to sow it with clover, as it added to the value of the hay, and from the strength of its tall stems, it prevented the clover from lodging, but the fact of ripening so much later than clover, causing a great loss from shrinkage, has done away with this practice, especially as orchard grass is so much superior in that respect. Timothy is not suitable for pasturing, having scarcely any aftermath. Besides, the

roots are easily destroyed if the stems are taken off below the first joint, this much being required for their vitality. For this reason, also it is necessary to be careful to *set the blade of the mower sufficiently high to leave the first joint intact.* As has been stated, the roots are both fibrous and bulbous. These bulbs have but few rootlets starting out from them, the plant depending for its support principally on the store of nourishment laid up within the bulbs. If, therefore, the stem is shaved off entirely, the bulbs, being deprived of all nourishment, throw out tubers all around, and these send up shoots, seeking food in the air, but they are feeble, and if spared by the frosts of winter are so crippled they fall an easy prey to the scorching suns of summer. For the same reason pasturing will effectually destroy a timothy meadow if persisted in. The stock will bite off all vegetation, leaving the roots to perish, or if hogs are allowed to run on it they quickly discover and destroy the succulent bulbs. When about half the blossoms turn brown, and at least the upper part of the spike or head is still purple, a yellowish spot will make its appearance at or near the first joint, and this is the true indication for the harvest to begin, for this spot will soon extend if allowed to remain, to the spike, and the whole plant will be a stem of wood. The appearance of this spot also tells of the maturity of the bulbs, and they are not so liable to injury from cutting as before. If this joint is left, the tubers will remain green and fresh during the entire winter; but their destruction is inevitable if it is taken away at any time during the year. These remarks do not apply with equal force to timothy when it has a fibrous root, but the two kinds are so intimately mingled there is no practical difference.

Timothy stands at the head of all grasses in its nutritive qualities. A specimen taken from the field according to the above directions, yielded on analysis, water 57.21, flesh-forming principle 4.86, fat-forming principles 1.50, heat-

producing principles 22.85, woody fibre 11.82, and mineral matters 2.26, in one hundred parts. (Way.) A comparison of its relative value as a food will be made further on. But the above nutritious specimen will never be produced, if the plant is allowed to stand too long. On the contrary, as a food it would become woody and worthless, all its starch, sugar, albuminoids, and other nutritive principles having been deposited in the seeds, and the stalk is nothing more than a woody support.

Cattle fed on this kind, or on hay that has been allowed to get wet and ferment, will quickly lose their flesh and the hair become rough.

Timothy is exhaustive to the soil, and being a heavy feeder, requires attention. No crop can be raised on ground, that will not extract a certain amount of its vitality, but unless something is taken the farmer would receive nothing. Therefore, it is the duty of the farmer to supply by manures, the deficiency that occurs. And this is made the more apparent from the fact, that, the man who applies the most manure will invariably get the best returns for his labor. On good, rich land, bottom is best, timothy will make two tons per acre. By a heavy application of compost or manure from the barn-yard, it can be raised to five tons, and the straw lengthened from two feet, its usual height, to five and even six feet, and from the same cause, the heads from two inches to twelve inches in length.

It is a great and sure bearer of seeds, but the seeds are easily destroyed by heat in the mow, unless precautions are used in caring for them. In fact, so many adulterations, and non-germinating seeds are thrown upon the market, it would be well for each farmer to save his own seed, by devoting a certain amount of ground to it. Let the timothy get fully ripe, and, by adjusting the mower, save as little stalk with the seeds as possible. This should be carefully spread and beat out as soon as convenient, and it is easily done.

The time of sowing is various. If sown in the spring it

is liable to be killed by summer heat, and if sown late in autumn, it runs the same risk with frost. It is, therefore, bad policy to run the risk of not only losing the cost of seed but also the labor of preparing the ground. Much must be left to the judgment of the farmer in selecting a suitable day, but it is safe to say that it should always be sown in the fall, early enough to get a root strong enough to resist winter killing. If sown in a very dry soil it will incur the further danger of germinating from dews, and of being killed by the sun. Select the time when the ground is moist and the days not excessively hot. The quantity of seed per acre is various, but the sower who spares his seed will reap in proportion. Not less than 12 pounds if mixed, and if alone at least three gallons of clean seed will be required to secure a good stand. But it will be better to test the seeds beforehand, for a failure from bad seeds will cause a year's delay.

Timothy does best on rich, alluvial, moist land. But any rich land, whether upland or lowland, will produce it, if proper attention is given. Wherever calcareous loam exists it can be profitably put to timothy. It will not grow to any extent at a greater elevation than 4,000 feet above the sea, but on any less height there is no grass capable of greater diffusion. In order to secure a stand of timothy, the following simple rules may be adopted:

1. Be sure of your seed by testing them before sowing.

2. Put plenty of seed on the ground; if too thin, it will require time to turf over, if too thick, it will quickly adjust itself.

3. Sow early enough to enable the seed to get a foothold before winter sets in. Late fall and winter sowings are always precarious. September is best if there is no drought, otherwise wait for a "season."

4. Unlike other grasses, timothy will not admit of pasturage. The nipping of stock will destroy the tubers.

5. NEVER CUT THE SWARD BELOW THE FIRST JOINT.
6. Be sure to have the ground well pulverized.

It is necessary to impress one idea that has already been stated. Do not allow the timothy to stand longer than the time that the yellow spot appears near the first joint, as it will from that time ripen very rapidly, and be worthless. General Harding, before the Farmers' Club, called attention to the fact, that, the greatest enemy of timothy is blue-grass. If stock is allowed to pass from a blue-grass pasture, at will, to a meadow of timothy, they will quickly sow the meadow in blue-grass, and the latter will, in a short time, supersede the former. In the meeting above alluded to, timothy being the subject of discussion, Gen. Harding being called on for his views, said "he had had considerable experience with timothy. He regarded timothy the most valuable of all the grasses for hay, and more especially for hay that must be handled or shipped or baled. He had tried several varieties. Many years ago timothy was a grass of which it was a very easy thing to secure a stand, and also a considerable amount of grass, and the meadow lasted for many years. He used to have meadows twenty, and even thirty years of age, but were, even at that age, good, productive meadows. Timothy was introduced into this country before blue-grass." The General remarked, he considered blue-grass a great enemy of timothy meadows. Before the introduction of blue-grass, our timothy meadows lasted almost without limit, and prodnced year after year, for twenty or thirty years. "But since we have been growing blue-grass more extensively, it gets into our timothy meadows in a few years and will root out the timothy; so now, in buying my timothy seed, I look more carefully for blue-grass seed than for the seed of any noxious weeds. I would rather sow dock—I would rather sow anything in my timothy than blue-grass. Still I value blue-grass in its place, as the first of grasses, yet it causes more trouble in our mea-

dows than anything else. Again, our seasons have become dryer, and there is much greater difficulty in getting a stand of timothy than formerly. When I commenced sowing meadows, I had no trouble in getting a stand of timothy, whether I sowed the seed in the fall or in the spring, whether I sowed in the fall with wheat or barley, or in the spring with my oats. For many years I never failed. Now I sow in the fall, and the timothy is frequently winter-killed; I sow in the spring, and it is killed by the long droughts of summer, but these difficulties should not deter us. We should continue to sow, and persevere until we get a stand. Hence, if I sow in the fall and my timothy is killed, I sow in the spring, if it is then killed, I sow again and again, until I succeed. I have never given up, and have never entirely failed, after repeated efforts. My sowing last spring was very fortunate; I have a very fine and promising young meadow now, of one hundred acres, that I sowed last spring a year ago. I am satisfied, however, that under the changed state of our climate, we must sow more seed than we have been in the habit of sowing. I got a good stand of timothy many years ago with a gallon of seed to the acre, now I would recommend not less than one and a half gallons, or even a peck of seed to the acre. Again, the better the stand you get, the thicker your grass comes up the more will it keep out the weeds. The white blossom, like the blue-grass, has also increased largely, and seems to be yet increasing. That is a troublesome weed for our meadows. Still that is not as pernicious as it seems to the inexperienced. True, you cannot sell white blossom in the market, but if you expect to consume the hay at home, and make your timothy with a large amount of white blossom in it, you will find you will have good hay. Stock will eat it, and readily; mules and cattle seeming to do almost as well upon it as upon the timothy alone."

"I know that some differ from me in considering the white blossom as troublesome as any other plant, and throw it

away. I have some hands to run along the windrow and pick out the white blossoms, and make hay of the white blossoms alone; it pays very well for the labor of separating it. I would rather not have to do it, for all the labor is needed at that season of the year; but I will not throw the white blossoms away, for it is valuable. I stack it in my pastures, and let the cattle go to it at will during the winter. I also stack my straw, and that helps the cattle."

"Sometimes there is also a fine growth of crab grass, and some fox-tail and rag weed. I rake this up; you cannot sell it in the market, but it largely pays for the labor of saving it. I have this winter kept a large number of steers that I expect to bring into the market next spring, and they have had nothing else but straw, and this kind of weed. I sprinkle a little salt on the stack, and the stock eat it and do well on it. I have no doubt but they would do better on the better hay, but I cannot afford to feed beef-cattle on first-class hay, worth one dollar per hundred pounds in the market, while I can save that which is not worth one cent in the market and feed it to them."

"It is valuable in another respect. It comes on at the conclusion of your harvest, and after corn is laid by. The clover comes on at the busiest season of the year, and hence I prefer the timothy."

"Now, what is the proper time to cut timothy? Some would say as soon as it blooms; others would say, after it has bloomed and the bloom has fallen. If I could cut it all on the day I thought it would make the best hay, I would cut it just about the time it has lost the largest portion of its bloom. If you cut it too green—like green fodder—the stalk will shrivel, and after being cured, the stalk will break short, but if allowed to get a little riper the stalk will bend."

"How much sun should it have? That is a question that can only be determined by experience. The proper time to put it up is when it has had as little sun as possible, so you

are assured it will not mould. If there is too much moisture in it, it will mould, and thereby injure the hay. If the weather is settled, it will cure better in cocks, but all these things must be governed by circumstances."

"The best time to cut hay is just after the bloom stops. I think timothy pays best sowed alone. It can be cured better in cocks, but sometimes in bad weather it will not do to risk it in cocks. I pasture my timothy meadows, but it assists in introducing blue-grass. I would prefer to sow in the fall, as early in September as possible. I have tried plaster on timothy, but do not know that I have derived any benefit from it. The best blue-grass land is the best for timothy, and I would prefer it to be rich limestone loam."

It is highly probable one cause of the General's meadows failing in six or seven years, is the fact, he admits, of pasturing them. It is a well ascertained fact, that timothy will not bear pasturing, and attention to this and leaving the first joint uncut will most probably make our meadows again live twenty or thirty years.

At the meeting of the Stock Breeders' Association, in February, 1878, Gen. W. H. Jackson, who is farming with Gen. Harding, said that they found the best forerunner of timothy to be Hungarian grass. If this is sown in the summer and harvested in August or September, and timothy sown upon the stubble and harrowed in, the very best stand could be obtained. The Hungarian grass destroys all noxious weeds, and gives a certain degree of compactness to the soil necessary to secure a good stand of timothy.

The porosity of the soils of the Central Basin makes this, or rolling of the land, essential conditions of success. On the clayey lands of the valley of East Tennessee or the Rimlands, there is no more difficulty in securing a stand of timothy than of herds grass or clover. I have seen as much as three tons of timothy hay cut from a bottom field on Red river in Montgomery county, nine months after seeding.

RED-TOP—HERDS GRASS—(*Agrostis vulgaris.*)

Erect stems, slender, smooth, polished, round; roots creeping, panicle oblong, leaves linear, ligule very short, lower paleæ mostly awnless, and stem nerved. Flowers in July.

It was introduced from England, where it was known as Bent grass. When first cultivated it went by the name of English grass. There are many species now raised in England, which are still known as Fine Bent. It is scattered over the whole State and but few old pastures are free from it, but there it is so dwarfed by close grazing and treading that it shows to but little advantage. It is commonly called in these situations fine-top.

Next in importance to timothy as a meadow grass stands Herds grass. Unlike the former, it also makes a good grazing grass—in fact grazing is necessary to its preservation, as, if allowed to go to seed a few years, it dies out. It loves a moist soil, and on swampy places that will grow scarcely anything else, herds grass will thrive wonderfully.

It is the most permanent grass we have, and by means of its long, creeping roots, will even, if sown too thin, quickly take possession of the ground. It is greedily eaten, while young and tender, in the spring by all kinds of stock, and affords a fine nourishing hay, though in less quantity per acre than timothy. It grows from two to three feet high, and with its purplish panicles, when in full bloom, presents a most charming sight in its soft feathery undulations.

It is oftener mixed with other grasses than sown alone, especially with timothy and clover. But it fails to come into harvest as early as clover, and the same objections may be urged against it that are to timothy. It yields, on moist bottom land, from one and a half to two tons per acre, but on uplands it is not a good producer. On thin lands it will

not gain a sufficient height to justify harvesting at all. It withstands the effeets of drought much better than timothy. In England it is supposed to grow best on sandy soils. Such soils suit it in West Tennessee. Its effects when fed to milk cows are to greatly enrich and yellow the butter, and European dairymen think they cannot do without it in their pastures. By the Woburn experiments at the time of flowering, it yielded 10,209 pounds of grass, which lost in drying 5,615 pounds, and furnished 532 pounds of nutritive matter. Cut when the seeds were ripe, it yielded 9528 lbs. of grass, which lost exactly half its weight in drying and afforded only 251 lbs. of nutritious matter. From this it would appear that this grass is doubly as valuable for feeding purposes when cut at the time of flowering. A writer in the *Rural Sun*, under date of February 18, 1878, institutes a comparison between the value of this grass and timothy.

"The experience of Mr. Smith, that timothy lasts but a few years, while red-top remains permanently, corresponds with the general experience of the country, viz: that timothy lasts about three years and red-top until it is replowed. While the yield per acre on our best lands would not be so much as timothy, yet our poorer soils which will not produce timothy, will bring fair crops of red-top. Timothy, having bulbous roots, is subject to be killed by being closely cut in hot, dry weather, and is not fit for pasturage, because the bulbs where bitten or bruised by being trod upon, die, and it is also likely to form tussocks. Herds grass, on the contrary, has fibrous roots, occupies the entire surface, makes a sod and bears close pasturage. Sown with clover, it will occupy the soil by the time the clover dies out. Herds grass seeds are now very cheap, and half a bushel of Herds grass seed sown to the acre with the clover sown in the spring, would pay well for the small expenditure. There are 425,000 seeds in an ounce of Herds grass seed, and this small amount evenly distributed over an acre would give about nine and three-fourth seeds to each square foot, while

the amount recommended, say one-half bushel of six pounds, would give, say 936 seeds to the square foot, or six and a half seeds to the square inch."

For stopping gullies in old fields it is superior to blue grass, as it will throw its long, searching roots from the top down the sloping banks of the washes, and fasten to every patch of good soil at the bottom, and then from every joint starts up a stalk to get a fresh hold. It affords a very good aftermath from which, in wet falls, a fair crop may be cut. Unless well tramped in the late fall it is liable to form tufts that rise out of the soil from the effects of freezing, and are destroyed. Therefore, after cutting, let on the stock and their feet will insure a good turf, and besides, will destroy weeds. But the cattle should be taken off the pasture after rains have filled the earth with water, or it will become too rough for the proper use of the mower.

The quantity of seed per acre, when sown alone, is about half a bushel. The seed is usually sold in the chaff, it being difficult to separate it. When badly cleaned a bushel per acre will not be too much.

The time for harvesting is when it is in full flower, or as soon thereafter as possible, when all the elements that are necessary to form the seeds are still in the stalk and leaves. Left to ripen fully, it becomes woody and innutritious.

Many pursue the plan of mixing the timothy and Herds grass together, as they ripen together, and the Herds grass being much lower than the former fills in well, and the two will make a more abundant yield than either separate. But one requires pasturage and that will destroy the other.

It should be sown in September, unless sown on wheat, and then as early as practicable, to enable the roots to get sufficient depth to resist the cold of winter. If sown alone it will, like timothy, make about a half crop the ensuing year. But it is a difficult matter to induce our Tennessee farmers to forego a crop of something every year, consequently it is usually sown over a grain field, either

wheat, rye or barley. There are a great many marshy spots in Tennessee, especially on the Tennessee and Mississippi rivers, so full of water that nothing can be cultivated on them, and on these fine crops of Herds grass could be secured every year, which would certainly be far preferable to allowing them to run to waste. These bottoms are usually of surprising fertility, and would go far to supply the great deficiency of hay and obviate the necessity of importing from our more thrifty northern neighbors. It is a perennial, and if properly tramped every autumn will keep good an indefinite length of time.

This grass also finds a most congenial soil throughout West Tennessee, in many places in that division of the State attaining the height of five feet. It is probably better adapted to all the soils of the State than any other grass. I have seen it growing in princely luxuriance 6000 feet above the sea on the bald places of the Unaka Mountains. It flourishes upon the slopes and in the valleys of East Tennessee. It yields abundantly upon the sandstone soils of the Cumberland Table-land, and beautifies the rolling surfaces of the Highland Rim. In the Central Basin it sparkles in the beauty of its verdure, and is second only to red clover and timothy as a meadow grass. No other grass is sown so much for hay upon the lands lying at the western base of the Cumberland Table-land. In Warren county especially it is highly esteemed for its longevity and fruitfulness. In reply to a communication addressed to him in regard to this grass, Mr. P. H. Marbury writes as follows:

OAKHAM, WARREN COUNTY, TENN.
January, 26, 1878.

J. B. Killebrew, Esq., Nashville, Tennessee:

You ask what soils suit best for Herds grass and the best time for sowing.

It grows well on clay soils, in the damp, marshy swamp lands, as well as on the highest elevations; will grow in sandy lands, but the land should be well packed by rolling or treading of stock.

It should be sown the last of September or first of October—any time after the equinoctial rains to the 15th of October. It is better to be sown alone, but will do very well sown with wheat. When sown in the spring it is usually overrun with weeds.

As a meadow or grazing grass it is very valuable. It yields on good soil from a ton to one and one-half tons of superior hay, the stems and blades much fewer and somewhat softer than timothy. I prefer it to timothy—my stock prefer it.

For grazing it is very valuable. Upon land where limestone is absent it flourishes, has greater tenacity of life, makes a sod almost impervious to hoof and tooth—in fact it is the blue grass of the mountain district. We have but little lime in our soils and therefore blue grass does not grow well. For a meadow I prepare the soil well with plow and harrow and sow one bushel of *clean seed* per acre, one-half one way and then sow the other half across the first so as to avoid leaving spaces unoccupied. A light brush may be dragged over it or not, as is preferred. I prefer to leave it without brush or roller. The roller is the best; in fact for a meadow it prepares the surface well for the mower or sythe. If sown by the first of October, alone, a crop of hay the next season may be cut perhaps equal to any it will ever afterward yield, and worth more than a crop of wheat or corn.

The time to cut for hay is just before the seeds ripen, but if seeds are desired let them ripen, and if cut immediately will still make fine hay. For pastures I would advise a mixture of orchard grass with it. Orchard grass grows well in the same soil with Herds grass.

I am gratified that you are giving to the country so much general information upon the subject of agriculture. It is yet possible to renovate our exhausted soils, and restore prosperity to our country again. Our soils and our mines are our wealth, but our people must be taught to understand the value of manures, the rotation of crops and the breeding and feeding of domestic animals.

TALL RED-TOP—(*Tricuspis seslerioides.*)

Spikelets, three to twelve flowers, glumes unequal, rachis of the spike bearded below each flower, lower palea much longer than the upper, convex, hairy on the back, three nerved and three pointed by projection of the nerve, stamens three, stigmas dark purple.

The Tricuspis, three pointed, is a meadow grass and thrives best on sandy soils or old fields. When in full bloom it makes a good show but does not yield a sufficiently large crop to justify sowing in preference to several others. It is said to be harsh and wiry.

CHAPTER VIII.

ORCHARD GRASS—WOOD MEADOW GRASS—ROUGH STALK MEADOW—CHESS OR CHEAT—ITALIAN RYE GRASS—MANY FLOWERED DARNEL—CRAB GRASS.

ORCHARD GRASS—(*Dactylis Glomerata.*)

With broadly linear, rather rough, pale and keeled leaves and a dense panicle of one-sided clusters, on which the spikelets are much crowded, each three to four flowered, both the glumes and the laterally compressed-keeled flower palet tapering into a short awn, rough-ciliate on the keel. Flowers in early summer. (Gray).

Whether a native of America or Europe, or indigenous to both countries, it is well known that Orchard grass is diffused more extensively than almost any other grass, growing all over Europe, the northwestern parts of Africa, and in Asia Minor. Known as Cock's foot in England for many centuries, it was not appreciated as a forage plant until sent to that country from Virginia. It is a perennial, and grows upon congenial soils any where between 35 and 47 degrees north latitude. It likes a soil moderately dry, porous, fertile and inclined to be sandy. On stiff, clay soils, retentive of moisture, the roots do not acquire such a vigor as to give a luxuriant top growth. The feebleness of the roots upon such a soil makes them liable to be thrown up by the earth. It may be grown successfully on a lean, sterile sort, by a top dressing of stable manure, yielding during a moderately wet season from two to three crops. In its rapid growth in early spring lies one of its chief merits, furnishing a rich bite for cattle earlier than almost any other grass. It also grows later in the fall. It

is very hardy when well set, makes a great yield, grows rapidly and vigorously upon suitable soils, supplies a rich, nutritious hay, which, compared with timothy, is in value in the proportion of 7 to 10. It starts out early in spring, and comes into blossom about the time of red clover. It attains a height, upon good soils, of three feet, though upon soils of great fertility it sometimes reaches the height of five feet. After being cut, it springs up rapidly, sometimes in rainy weather growing three or four inches within a week. This quality of rapid growth unfits it for a lawn grass unless cut every week.

Nevertheless this very quality makes it stand unrivalled as a pasture grass. The Hon. John Stanton Gould says in his essay upon this grass: "The laceration produced by the teeth of cattle instead of injuring, actually stimulates it to throw out additional leaves, yielding the tenderest and sweetest herbage."

The chief objection to Orchard grass is that it grows too much in stools or tussocks. This can be remedied by sowing a larger quantity of seed per acre. Never less than two bushels (14 pounds to the bushel) per acre should be sown, and two and a half bushels would even be preferable. Mr. Gould says that if the meadows are dragged over in spring with a fine toothed harrow, and then rolled, this disposition will be completely overcome. The disposition to stool can also be checked by sowing with other grasses. A half gallon of clover seed, one gallon of herds grass, and two bushels of Orchard grass,per acre, sown about the 25th of March, in our latitude, will make an excellent pasture. By the middle of June, upon good soils, the amount of forage will equal the best fields of clover. It should not, however, be pastured the first season until August, however tempting it may be. In this many Tennessee farmers have made a mistake. By pasturing before the roots are well established much of the grass is pulled up and destroyed. I have met with many farmers who condemned the Orchard grass for

want of hardiness and endurance, but in every case the fault was with the farmer himself in pasturing too early.

Orchard grass grows well in the shade, and hence its name. It withstands hot, dry weather better than any other valuable grass. Three good crops of leafy hay, if the weather is seasonable, may be counted on after the first year, but only one will blossom.

The analysis Prof. Way of the green grass in blossom by gives the following result:

	Per cent.
Water	70.
Fatty matter	0.94
Flesh formers	4.06
Heat producers	13.30
Woody fibre	10.11
Ash	1.59

Analysis by Scheven and Ritthausan gives:

Water	65.00
Fat	.80
Flesh formers	3.00
Heat producers	12.60
Woody fibre	16.10
Ash	2.40

The Woburn experiments developed some interesting facts pertaining to this grass. Grown upon a rich, sandy loam, and cut the middle of April, the green grass weighed 10,209 pounds per acre, in which there were 1,190 pounds of nutritious matter. Cut, when in full bloom, the green produce weighed 27,905½ pounds. This lost in dessication 16,045 pounds, or a little more than half, and furnished 1,089 pounds of nutritious matter. After the seeds were fully ripe, the green produce weighed less by 1,361 pounds per acre, but there were 1,415 more pounds of dry hay, with an excess also of nutritive extract of 363 pounds. The aftermath, however, was not so good, and in the loss of this the advantage of an increased yield of hay was counterbalanced.

The hay made of orchard grass, as analyzed by Wolff and Knop, gives:

Water	14.3
Organic matter	81.1
Ash	4.6
Albuminoids	11.6
Carbohydrates	40.7
Crude fibre	28.9
Fat	2.7

The albuminoids are the nitrogenous compounds or flesh-formers; the carbohydrates are the non-nitrogenous compounds, and includes the fat, starch, sugar, pectin, etc. Mr. Sinclair, by a series of experiments carefully conducted, demonstrated that Orchard grass, more than any other grass, when young, yields the greatest amount of nutrition.

It is of great importance that the seed from hardy plants be sown. In no department of agriculture does the old maxim "like produces like" obtain in a greater degree than in this grass. Seed from weakly, sickly plants will produce the same kind of offspring, however fertile the soil may be. Messrs. Lawson and Son, by selecting the best seed, and sowing for several years none but the best of each generation, established a new variety of Orchard grass, known by its great size and vigor as the Giant Cock's foot. Let farmers be careful, therefore, in saving seed to sow from the most vigorous growth.

The reason why so many bare spots are seen in pastures and meadows of this grass is due to two causes: 1st, the land is generally not half prepared to receive the seed; and 2d, there is a penny wise and pound foolish policy in sowing too few seed. Let the land be well broken by deep and thorough plowing, and then be finely pulverized by repeated harrowings. Sow the seed, the thicker the better, and run a light brush or harrow over the land, so as to cover the seed slightly. Mr. W. D. Gallagher sums the whole matter up: "Plow the land deep, pulverize the soil well, be generous as to the quantity of seed, let that seed be good, sow it evenly, give the land as good treatment afterwards as is given to meadow lands in timothy."

Its chief superiority over timothy lies in the value of its aftermath. It will improve under depasturing when a timothy meadow would be rendered worthless.

To sum up the merits of this grass:

1. It is better suited to every variety of soil than any other. I have seen it growing with vigor on mountain heights and in valley plains, on sandy loams and calcareous soils: on the coarse sandstone soils of the Cumberland Mountain, and on the tertiary loess and alluvium of West Tennessee as well as upon the cretaceous sands of that division. I have grown it upon the siliceous soils of the Rimlands, and have seen it enliven the landscape of the Central Basin with its mantle of verdure. It is best adapted to the sandy loams of West Tennessee and to the lands of the Central Basin having a porous subsoil. On lands having a tenacious clay foundation, the roots are checked in their descent, and the growth is not so luxuriant, nor is the duration of the pasture so great.

2. It will grow with greater rapidity than any other grass, and for this reason will sustain a large number of animals, and is excellent for soiling purposes.

3. It will grow in the shade. This quality will enable the farmers to utilize their woodlands as pasture, and so make them a source of profit.

4. It will resist drought better than any other grass. The hot summers make this a very valuable quality in any grass. Often in July and August the pastures become so parched as to afford but a small amount of grazing. Orchard grass then comes to the rescue and supplies the deficiency. According to Col. Bowman, of Kentucky, Orchard grass, owing to its capacity to resist drought, and in consequence of its rapid growth, will yield more pasturage than the best blue grass sod.

5. It is both a pasture and a hay grass. After a crop of hay has been taken off in June, the aftermath will furnish a good pasture throughout the remainder of the summer.

A prominent sheep raiser of Tennessee who has been carrying a thousand sheep or more, says, during the summer it will carry double as many sheep as blue grass, acre for acre; but that blue grass will furnish more and better winter grazing.

6. It may be sown in the spring or fall with small grain or alone. It is best not to sow it with grain, as the extra production of grass, when sown alone, is worth more than the grain and grass grown together. It may be mown as hay or cut with reapers or cradles, and bound in sheaves like oats.

WOOD MEADOW GRASS—(*Poa nemoralis*).

Spikelets ovate, compressed, flowers two to ten in an open panicle; glumes shorter than the flowers; lower palea compressed, keeled, pointless, five nerved; stamens two or three, seed oblong, free; stems tufted; leaves smooth, flat and soft

This, together with many others, belongs to the same family with blue grass. It grows from one and a half to two feet high; has a perennial creeping root, and an erect, smooth, slender stem. It grows in swamps or watery soils, and very rank, and flowers in June, ripening its seed the following month.

It has not been utilized as a meadow grass in Tennessee, but from its luxuriant foliage, it would appear to be a good kind for mixing in swampy soils with other grasses, as stock are exceedingly fond of it, affording, as it does, a very fine, succulent, nourishing food. On analysis it yielded water 87.58, flesh-forming principles 3.22, fat-forming principles .81, heat-producing principles 3.98, woody matter 3.13, mineral matters 1.28, from 100 parts, cut green. It is thus,

as will be seen, but little inferior to blue grass. It is best sown in September or February, on the snow, and requires two pounds of seed per acre. It is a fine pasture grass as well as meadow.

ROUGH STALK MEADOW—(*Poa trivialis*).

This species of the Poa is a favorite in England, and stands there in the same estimation as the blue grass does here. It may be said to be a giant blue grass, as it grows very tall, and yields about a ton of hay the first cutting. It can with difficulty be distinguished from the blue grass, except in size, and wanting the wooly covering of the seeds, as in the latter. However, it does not resist the inclemencies of the weather as well as blue grass. In this climate it would be a valuable mixture with other grasses, as it affords a good aftermath, but alone it does not turf well. On analysis, it yields almost identically the same ingredients with blue grass. It is eaten greedily by all kinds of stock, and though it does not make a very early pasture, it yet grows rapidly when the weather becomes warm. It is well adapted to moist, clayey soils. When sown alone, twelve pounds of seed per acre are used. Pastured too heavily, the roots become exposed to the sun, and it is liable to be destroyed by the heat. It mixes well with orchard grass. Calcareous loams are best suited to it.

WILLARDS BROME—CHESS OR CHEAT—(*Bromus secalinus.*

It belongs to the family of Bromes, has panicled flowers with spikelets, from five to many flowered; glumes not quite equal, shorter than the flowers, mostly keeled, the lower ones five, the upper three to nine nerved, palea herbaceous, lower one convex on the back or compressed, keeled, five to nine nerved, awned or bearded from below the tip, upper palea at length adhering to the groove of the oblong grain, fringed on the keel, stamens three styles attached below the apex of the ovary.

This pest and scourge of the wheat grower is not treated of here for the purpose of encouraging its growth as a food

for stock, but rather as it has been lauded by some writers as a good food, to expose its worthless and deleterious effects when once engrafted on our fields.

We have given in the "Wheat Culture of Tennessee," a resume of its history and character more fully than will be necessary here, to which the reader is referred.

The grasses of this series are coarse, with large spikelets, generally, when ripe. A few years ago this terrible pest was heralded by a great many agricultural papers as being a fine hay for cattle, and the seed was advertised and sold at enormous prices. The public, always anxious to be humbugged, and ready to get a crop without adequate work, readily took the bait, and it at once became popular. A Mr. Willard was mainly instrumental in giving popularity to this scheme, and hence, fastened his name to it. Several agricultural societies lent their influence to the humbug, and so it ran its short course of popularity. In fact, it is only eaten by cows when they can get nothing else. It has some nutritious properties about it, as has almost every other kind of grass, but its injury to the farm far surpasses any supposed virtues it may possess. The seed is a mere point of albumen, sheathed in such a matting of hulls as to be almost impervious to moisture. Placed below the vivifying influence of the sun and air, it will remain uninjured in the earth many years, and then when, by stirring the ground, it is brought to a germinating depth, it will at once raise its baleful head, as if triumphant at its victory over man.

Thus, when once introduced into a farm, it is years before it can be destroyed, in fact this can only be done by persistent cultivation. It will ruin wheat, both by impairing its quality, and hence its sale, and also by appropriating the fertilizing qualities of the soil, which should go to the sustenance of the wheat.

A common error, that it belongs to the same order as wheat or triticum may be exposed at once by reference to

the botanic description given above. It is a well known axiom, that each order of grasses is maintained indefinitely, though different species hybridize with each other. Thus, for instance, many species of the Bromes may be created by hybridization, and many species of wheat can be generated from a like hybridization of Triticii; but never has there been, nor will there ever be, an instance in which wheat can be changed into chess or blue grass. As easily one as the other. The laws of nature forbid it, otherwise there would soon be no regular order of vegetation, or in point of fact, of animals, for one rule would govern all, and cows would mingle with horses, dogs with man, and lions with hogs.

Dr. Flint instituted some experiments as to the relative value of cheat as a food, and with singular good sense selected the only competent judges to determine the fact—a jury of cows. Being placed in a stable, they were fed in the same manger with timothy and herds grass mixed, and cheat. The hay was eaten and the cheat left. With swale hay (a mixture of wild grasses and sedges, a very inferior hay), the swale hay was eaten and the cheat left. With reed canary grass (the most inferior hay of New England) they were both eaten alike. With cheat and oat straw, the cheat was eaten first.

With reed canary grass and hay, the hay was taken first.

With reed canary grass and swale, the latter was selected.

With reed canary and corn stalks, the latter were preferred.

With cheat and millet, the millet was taken, cheat left.

With cheat and corn-stalks, both were eaten alike.

These experiments demonstrate its character as a food, as being by no means commensurate with its character as a pest.

ENGLISH RYE GRASS—(*Lolium perenne.*)

Introduced into this country from Europe, a good pasture grass, one to two feet high, with loose spikes five to six inches long, seven to nine flowered, twelve to eighteen of them arranged alternately on the flexuous rachis, glumes single, fine nerved, linear—lanceolate, mucronate. Paleæ herbaceous, equal, the outer palea of the lowermost floret shorter than the glumes. Panicle spiked, about six inches long. Culm one to eighteen inches high, erect, bearing five to six leaves. Joints purplish, the first and second rather remote. (*Gould.*)

This was the first grass cultivated in England, and is a great favorite, occupying the same position there that timothy does with us. It is but little cultivated in the United States. It is said to impoverish land rapidly, and will run out in a few years. The shortness of its roots will not permit it to endure drouth, but it is adapted to a great variety of soils. It is of quick growth, and will sometimes yield forty bushels of seed per acre. It produces a nutritious herbage. There are no less than seventy varieties produced in England. Wolff's and Knop's analysis shows the hay to contain:

Flesh formers	10.2
Heat producers	38.9
Crude fibre	30.2
Fat	2.7
Ash	6.5
Water	14.3

One of the most valuable species of this grass is the *Lolium Italicum* mentioned below. We do not regard the ordinary English rye grass of special value to Tennessee farmers.

ITALIAN RYE GRASS—(*Lolium Italicum*).

Spikelets many flowered, solitary, on each joint of the continuous rachis edgewise, glume only one, and external. Distinguished from Darnell by the glumes being shorter than the spikelets.

Prof. Way gives the following analysis of this grass: Water 75.61, flesh-forming principles 2.45, fatty matters .80, heat-producing principles 14.11, woody fibre 4.82, mineral substances 2.21. See table in chapter III.

This grass has been lately introduced from Europe, where it is said to be more universally adapted to all sorts of climates than any other grass, and is very popular there. It grows from two to three feet high, and on moist, rich land, will perhaps bear cutting as frequently as a soiling or green forage crop, as any other grass, affording a succession of green cuttings until late in the fall. It can be forced by manures and irrigation to a greater extent than any other known species of hay.

However, as can be seen from its analysis, it has, when green, nearly half less nutrient properties than timothy, and unless the farmer wishes to cut it as a green food, it has no advantages over the latter. It is an annual with a fibrous root, and bears grazing well. The time of sowing is early fall, and ten pounds of seed are required per acre, a bushel weighing eighteen pounds. It is a valuable grass for Southern farmers, where hay is scarce and high. Being sown in the fall the farmer will be enabled to cut it early in the spring, thus giving the stock a change from corn alone to succulent hay. It has been fully tested in Georgia, and has given great satisfaction. It gives a fine color to the butter of cows fed on it, and they eat it with great

relish. It withstands the hottest suns of summer as well as the frosts of the severest winter. It must be sown alone, as it will quickly choke and destroy clover or other grasses. Its yield per acre, according to received authority, is something immense. Mr. Dickens, of England, sowed it on a stiff, clay soil, well-manured, cut it ten times during one year; the first time, ten inches in March; April 13th again; and May 4th a third time; May 25th a fourth time; June 14th again; July 22d a sixth time, with ripe seed and three loads hay to the acre. Immediately after each cutting it was manured with liquid manure, the produce of each crop increasing with the temperature of the atmosphere, from three-quarters of a load, the first cutting, to three loads the last. He discontinued manuring now, thinking its growth would be terminated in bearing seed, but he afterwards cut four crops from it. On the 26th January following, it measured sixteen inches in height. The last cutting was October 30th; and on the 8th April a crop of twenty-two inches high was cut from it. "I was desirous to know the exact amount taken per acre for the year, and it amounted, on a careful measuring and weighing of green hay, thirteen tons and eighteen hundred and twenty-seven pounds per acre!" (Coleman's European Agriculture.)

It presents a most charming view, with its broad, dark-green foliage, and especially in a dry year, when vegetation is parched up all around, it does not show any signs of losing its fresh, living, luxuriant growth. Although an annual, a meadow of this grass may be made perennial by scattering fresh seed over the ground every second year, and scratching it with a harrow with sharp teeth. Its unusual ability to withstand the vicissitudes of heat and cold would make it a desirable grass in any thirsty soil, as well as in moist ones, and might possibly be a valuable addition to the soils of the western portion of our State. At least it is worthy of a trial.

Mr, Gould thinks the valuable qualities of this grass may be summed up as follows:

"Its habit of coming early to maturity.

"Its rapid reproduction after cutting.

"Its wonderful adaptation to all domestic animals, which is shown by the extreme partiality they manifest for it, either alone or when mixed with other grasses; whether when used as green food for soiling, as hay, or as pasturage, in which latter state its stems are never allowed to ripen and wither like other grasses.

"Its beneficial influence on the dairy, not only augmenting the flow of milk, but improving the flavor of the cheese and butter.

"Its uncommon hardiness and capacity to withstand the vicissitudes of both wetness and dryness."

MANY FLOWERED DARNEL—(*Lolium Multiflora*).

This is almost identical in appearance with the preceding, and with very much the same qualities, surpasses all other in showiness of appearance. It has been cultivated long in France, and about forty years ago it was carried to England, and from thence to this country. It resembles, and is often taken for another species of Lolium, or tares of Scripture, that is an exceedingly troublesome weed, and has poisonous seeds, hence the parable of separating tares from wheat had a forcible application, and was readily comprehended by the hearers.

CRAB OR CROP GRASS—(*Panicum Sanguinale.*)

Erect, one to two feet, leaves and sheaths oftener heavy, spikes five to nine, digitate, spreading from four to six inches, rachis flexuous, spikelets oblong, lanceolate one and a half lines, upper glumes one-half as long as the flower, lower one minute, waste grounds. (*Wood.*)

This grass must not be confounded with the *Eleusine Indica*, also called Crab grass, from its supposed resemblance to a crab.

This species is so familiar to every Southern farmer that

it would seem to be superfluous to notice it. But as little as it may appear, it is one of our most valuable indigenous grasses.

Crab grass is an annual, and so full of seeds is it, that it is never necessary to sow it. It is never cultivated alone, which could be easily done by sowing the seed on a smooth surface about the first of June. When the cultivation of a piece of ground ceases, it at once takes possession of it, and soon furnishes a fine pasture. It grows not only in the cultivated fields, but in old pastures, yards and woods.

It is a fine pasture grass, although it has but few base leaves, and forms no sward, yet it sends out numerous stems, branching freely at the base. It serves a most useful purpose in stock husbandry, and the northern farmers would congratulate themselves very much if they had it to turn their cattle on while the clover fields and meadows are parched up with summer heat. For want of it they have to resort to soiling with green forage raised for the purpose. It fills all our cornfields, and many persons pull it out, which is a tedious process. It makes a sweet food, and horses are exceedingly fond of it, leaving the best hay to eat it. Should it be desired to secure a good crop of it, do not pasture the wheat or oat stubble, except with hogs, until the crab grass gets a good start, then take off the hogs, and allow it to get into bloom, and if the land is good, there will be a paying quantity to save. But be extremely particular about getting it wet, as from its porous character it will not stand the slightest rains after it is cut. Or if it is desired to fallow a piece of land for wheat, break it up in the spring, allow the weeds to come up a few inches, and about the first of June break again, plowing under well the weeds, and then harrow and roll, and in September there can be cut a large quantity of good, though light hay, from the piece. The freedmen of the State secure large quantities of it from surrounding fields for their stock.

CHAPTER IX.

MILLET—BARNYARD GRASS, BENGAL GRASS, GAMA GRASS, EGYPTIAN GRASS, MEADOW OAT GRASS.

Millet—(*Panicum Miliaceum*).

Spikelets panicled or racemed, sometimes spikes; glumes two, the lower one short minute or wanting; lower flower neutral, rarely awned, upper perfect; stamens three; stigmas usually purple.

This description covers the general characteristics of the millet family, though each one differs in some respects from the other.

The common millet has flowers in large, open, nodding panicles, leaves lance-shaped, broad stem one to three feet high; a native of Turkey and an annual. German Millet and Tennessee Millet have a thick, nodding spike, compound, six to nine inches long, purplish, afterwards yellowish, bristles two and three in a cluster. Introduced from Europe.

MISSOURI MILLET—(*Panicum Italica*). Same description as others.

These grasses have been cultivated extensively in the State for many years. Besides the species mentioned, there are many others, but they are only varieties of one plant. In Europe and in the Indian Islands, the seeds are used extensively as food for man, the seeds abounding in nitrogenous principles. Great quantities of seed have been raised in the State for exportation, and the yield per acre is very large when properly cultivated. The low prices it has y elded for the last two years, has almost put a stop to its cultivation. The reason, no doubt, of the want of demand is its inferior character as a cattle food. It at one time, enjoyed a wide-spread fame, and it was only the starving

appearance of stock, that led people to depend less upon it. At one period, it was deemed sufficient food for any stock, without the aid of anything else. The fodder was hay and the seed was corn. But later investigations have demonstrated the fact, that when hay ripens seed, its usefulness as a hay measurably ceases. Were stock fed exclusively on seed-heads, with a sufficiency of good hay, they would thrive exceedingly well, or if the millet is cut while in the flower, or even when the seed is in the milky state, and fed to stock in combination with grain, they would do well. But even then, it is much inferior to oats, timothy, or herds grass. Its only special recommendation is, that it yields a larger proportion of hay than other grasses. It requires a rich, dry soil, and will stand almost any amount of droughts, seeming to dry up during the heat, but when it rains it will start off with renewed life, and do as well as ever. It makes large quantities of seed per acre, the Hungarian yielding 30 bushels; the Missouri 40; the Tennessee 50; and the German from 60 to 80 bushels per acre. The Hungarian millet is a better hay than either of the others, but its yield is much less. The Tennessee millet perhaps yields more hay than either of the other three, but the Missouri has more reputation as a feed for cattle. Should it be wished, however, to sow for a money crop, it will be far preferable to sow the German millet. The Hungarian has a small head, a simple spike, while the others have compound spikes, most notably the German. It is easily raised, at less cost than corn, and makes, on good ground, nearly double as many bushels as the latter per acre. It is a good grain for stock of any kind, if crushed, the smallness of the seed preventing comminution by the teeth. Should it be desirable to raise it for stock, it will make an excellent food, to feed it in the head, without the expense of threshing. For all kinds of fowls it is unsurpassed, and it is a powerful stimulant to laying eggs. Chickens having a supply to go to, will continue to lay

through the whole winter, and at the prices it has been selling for, for two years, nothing is cheaper.

To sow for hay prepare the ground in a thorough manner, pulverizing it completely, and when the ground is in a sufficiently moist condition, in June, sow the seed, a bushel to the acre. Never sow if the ground is too dry or too wet. If too dry, the seed near the surface will parch in the rays of the sun, and a stand will fail to appear. If too wet the usual injury to the land occurs and the crop "frenches" or turns yellow and dwarfs. After sowing, harrow well and the labor is over. The millet will require seventy or eighty days to mature, unless it is sown in July, when it will require a few days longer.

Two crops of Hungarian grass can easily be raised from the same ground annually. A farmer of Davidson county raised a most excellent crop of Hungarian grass, sown the 1st day of September and cut on the 10th of October. Another, of Williamson county, secured a good crop of German millet sown on the 13th day of August, and cut on the 12th day of October. So, if a farmer, by any kind of misfortune, fails in the earlier months to secure a sufficient quantity of forage for his stock, he can, as a dernier resort, start very late in supplying himself, by crops of millet. Should it be desired to use the hay as a green forage, it can be cut three times at least, provided it is done before it begins to throw up the seed stalks. It is a common custom in the Southern States to use it in this manner instead of buying the expensive baled hay of the North.

For seed, prepare the ground as above described, and then, with a light bull-tongue or skooter plow, run light parallel rows thirty inches apart, and with a tin cup or old oyster can that has three or four holes punched in the bottom with a 4-penny nail, walk rapidly along the furrow, and the seed will sift into it from the cup about right for a stand. Cover very lightly with a cotton coverer, and then, just when the seeds begin to sprout, but before they show

the sprouts above ground, run over the field with a harrow, and there will be no further trouble. Afterwards cultivate with a cultivator and double-shovel, one plowing with each being all that is required. It will be necessary to thin out the Tennessee millet with hoes, leaving a mere thread of stems, as it stools prodigiously, but this will be unnecessary with either of the other three, as they scarcely stool at all.

It must be cut with reap hooks, taking just enough of the head to enable the laborer to make it into bundles; or if preferred, it can be broken off at the head, taking only the seed, leaving the stubble to renew the soil. If it is intended to thresh it, the reap hook must be used, as it will not thresh clean alone, but if the farmer wishes to tread it out on a barn-floor with horses, the straw would involve much waste, as the seeds become entangled with the straw, and will not easily separate from it. They are, after treading, separated from the chaff with an ordinary wheat-fan.

This grass is of great value to the renter who has no opportunity of continuing in possession of the land long enough to set a meadow. But for the landowner, there is no excuse for not providing himself with the best hay the climate and soil affords, and there are plenty of good grasses to suit every variety of soil in the State of Tennessee. If a farmer who is a landowner wishes to indulge the pride, and it is an economical pride, of having fat horses, sleek cattle, and plenty of bacon, let him at once see to his meadows, for a good meadow is next to a corn-crib to prepare pork for the smoke-house, as well as to fatten all kinds of stock. A crop of millet is a good forerunner for a meadow, as it destroys all the noxious weeds, and leaves the land in fine condition for timothy or herds grass.

An analysis of Hungarian grass by Wolff when green shows:

Ash	7.23
Potash	37.4
Magnesia	8.0
Lime	10.8
Phosphoric Acid	5.4
Sulphuric acid	3.6
Silica	29.1
Chlorine	6.4

BARNYARD GRASS—(*Panicum crus-galli*).

This grass is quite common in wet, swampy places, and has spikes alternate and in pairs, sheaths smooth, rachis bristly; stem from two to four feet high, stout, erect, or somewhat procumbent leaves half an inch broad; panicle dense, pyramidal, glumes acute; arms variable in length, sometimes wanting; outer palea of the neutral flower usually awned. It flowers from August to October.

It is a species of millet, but has received but little attention here as yet, though some efforts have been made to test it. It has never been utilized in Tennessee, but is cut on the coasts of England as a constituent of swale hay. It will, probably never supersede any of the many excellent meadow grasses we have. It is succulent and nutritive, and when green, is eaten by stock with a relish, and it gives a very large yield of hay.

BENGAL GRASS—(*Setaria Germanica*).

A species of millet introduced from Europe, and described under the head of millets.

GAMA GRASS—(*Tripsacum dactyloides*).

Spikelets in jointed spikes, staminate above, fertile below; staminate spikelets two, both alike; two flowered, lower glume nerved; upper boat-shaped; pale, thin, awnless; anthers opening by two pores at the apex; stems tall and large, solid, from thick creeping roots; leaves broad and flat.

This is in some sections called sesame grass. It is the largest, and one of the most beautiful grasses we have, growing to the height of seven feet. It is abundant throughout the Mississippi Valley on moist, slushy places. When young and succulent, it is eaten with avidity by stock, and

makes from its rapid growth a good soiling or forage crop, but when it gets large its stem is so woody stock refuse to eat it. Its leaves are very large, equal in size to the leaves of corn, but they are rough and hairy.

The grass may be cut three or four times a year, and though in its native state it grows in swamps, it thrives almost equally well on dry or sandy ridges. It will grow where timothy or herds' grass will not, and consequently is well suited to a large section of our State. The quantity of hay taken from one acre is simply enormous, and resembles very much corn fodder, and as a hay is fully equal to it, and it can be saved at one tenth the labor required to save fodder. The roots are as strong and large as cane roots, so let it be sown where it will not be desired to remove it. However, close grazing for a few years will destroy it.

It is very nutritious and succulent when cut green. The great mass of roots it has will serve to open, loosen and improve the land upon which it grows. It should never be allowed to shoot up the seed stem when desired for hay.

It is with difficulty the seed can be made to vegetate, and therefore it must be propagated by slips from the roots. Prepare the land well, lay off the furrows with a bull-tongue plow two feet apart, and drop a small piece of root about two feet apart in the furrow, covering with a board. The creeping roots will soon meet, and the ground is quickly turfed with it. It should be planted early in September. Of course, the richer the land, whether upland or bottom, the greater the yield, as the time has never yet come when poor land will make better crops of anything than fertile land. I have seen it growing with great luxuriance in Montgomery county.

EGYPTIAN GRASS—(*Dactyloctenium Egypticum*).

This grass is a native of Virginia, and has diffuse stems, often creeping at the base; spikes four or five, leaves hairy at the base.

This is an annual grass, is found in yards, is very troublesome, and is entirely worthless. It is not a meadow grass

at all, but is placed in the list simply to warn buyers of seeds not to purchase it, as the Means' grass under the name of Egyptian grass, has obtained a considerable reputation, and it would be easy for a swindler to palm off this for the former.

MEADOW OAT GRASS—(*Avena pratensis*).

Spikelets three to many flowered, with an open, large, diffuse panicle; lower pale a seven to eleven nerved, with a long, usually twisted awn on the back, grain oblong, grooved on the side, usually hairy and free.

This is a perennial grass, and is a native of Great Britain. It is one of the few grasses that do best on a dry soil. It grows to the height of only eighteen inches in its native pastures. But here it is quite a different grass, and rises to the height of from five to six feet. It will not grow well on moist soils, but on rich upland or good sandy land it grows with vigor. It deserves a place on every farm, as the hay is excellent, and is greedily eaten by stock, and besides, the yield is extremely large. Another advantage is that the seed will be ripe before the hay turns yellow, so that not only the hay will be saved, but a large amount of seed can be secured; upon a barn floor enough will shatter out to supply the wants of most farmers. Or if the farmer wishes to sell the seed, he can cut off the heads with a cradle, and let the mower follow for the hay.

Should the autumn prove a wet one, a second crop can be cut, but if there is not sufficient aftermath to justify cutting, do not pasture it, but allow it to grow on as long as it will, and it will about Christmas turn over, the tops turning yellow, but underneath there will be a magnificent pasture, all prepared for the hungry stock, and it will continue to sustain them until other grasses take its place. However, should it be desired to use it for hay the succeeding year, the stock should be removed about the middle of February.

It will seed in the fall, after being sown in the spring, which is the proper time to sow it. Sow two bushels per acre. The seed is very light and chaffy. It is a tussock grass, and does not spread from the roots, consequently the seed must be depended on for a stand. After the first sowing, there will be no difficulty in obtaining seed, as the yield is large. It affords both for hay and pasture, perhaps more green food than any grass we have. Dr. Flint describes this grass under the name of Perennial Rye Grass (*Lolium perenne*), and thinks the best time to cut is while in the flower, and the experience of every one in other grasses would seem to justify this opinion.

CHAPTER X.

MEANS, JOHNSON, EGYPTIAN GRASS.

SORGHUM—(*Halpense.*)

Rises with a stem from four to twelve feet high, according to the soil on which it grows, erect, smooth; leaves linear, flexuous, graceful, curling down at the end like corn; flowers in a panicle at the top, at first green, changing gradually to a yellow.

A few years before the late war, Capt. Means, of South Carolina, who commanded a trading vessel to the Mediterranean Sea, brought from Egypt a lot of seeds, from which he got a spoonful of seeds of an unknown kind. He handed them to some one with a request that they be sown in his garden. They came up and proved to be the grass named above. It was of an unknown quality, and but little attention was paid to it, until it nearly took his garden. He had the plants dug up by the roots and thrown into a neighboring gulley, where they soon began to grow, stopping the wash and spreading all around. It was now seen for the first time that it was greedily eaten by stock. This was suggestive in a country where all the hay had to be imported, and so seed was gathered and sown, and the wind spread the seed all around from the growing grass. It puzzled farmers to know it from corn, and it was often left for corn in the field when thinning out, so that the negroes abbreviated the local name and called it "mean grass."

In 1860, Capt. Johnson, of Marion Station, Alabama, paid a visit to some relatives and heard of this grass, that had in the meantime acquired a great reputation, and on his return he carried home with him a bushel of seeds and sowed them on his plantation. Soon after he went into the Confederate service and was killed, leaving two little girls. These girls were sent to school at Tuscaloosa, but having

no guardian and no means, the president had a gentleman appointed guardian who went to Marion to see if his wards had anything. In the meantime the plantation was left alone, no one caring for it, and it was unrented. He found it a large place, and almost entirely covered with the *Means grass*, the winds and stock having set it everywhere. Being a shrewd man, he saw its capability and at once advertised it as a stock farm, and soon rented it to Mr. R. C. Gardner and J. C. Copeland, Esq., of Nashville. They saw their opportunity, and at once, securing a number of baling presses, set to work cutting and baling hay for the Southern market.

The hay proved popular and sold well wherever tried, as stock delighted in it, leaving all other kinds to eat it. Applications naturally poured in for some of the grass, and so they sold immense quantities of the seed, and also of the roots, getting large prices for both. So great was its popularity that at the end of their five years lease a company of Northern men out-bid them, and have resorted to steam to assist in the baling process.

Egyptian Sugar Cane, as its proper name is, is a daughter of the Nile, where it grows fifteen or twenty feet high. So great is its luxuriance there that it has filled all the upper Nile so that a canoe cannot be driven through it. Great numbers of cattle and wild animals resort to it, and, in fact, it is the chief sustenance of ruminants in that country.

When young it is very tender and sweet, the pith being full of sugary juice. The leaves are as large as corn fodder, and very nutritious. It has a perennial root, and so vigorous that when once planted it is a difficult matter to eradicate it. So care must be taken to plant it where it is not intended to be disturbed. The roots are creeping and throw out shoots from every joint. It is a fine fertilizer, and sown on a piece of poor washed land will, in a few years, restore it to its pristine fertility. But there is really not much difference where it is sown, for a farmer once

getting a good stand will not want to destroy it. It will bear cutting three or four times a year, and in fact, it has to be done, for when it matures the seed, the stem and leaves are too coarse and woody for use.

Jno. B. McEwen, Esq., of Williamson county, procured a bushel of seed from Dr. Gardner, and last year cut it four times, getting a large amount of hay each time. He is delighted with it, and says it is the best hay he raises, and his dictum is of value, as he stands deservedly among the best of our farmers.

The ground must be well prepared as in other grasses, and in September, the earlier the better, let it be sown, one bushel to the acre.

It can be propagated also by the roots, by laying off the rows each way and dropping a joint of the root two feet apart and covering with a drag.

It gives the earliest pastures we have, preceding blue grass or clover a month. Hogs are fond of the roots, and any amount of rooting in it will not injure it. In fact it is a *stick tight*. It not only thrives well on bottoms, but it will grow just as well on upland, and though poor upland will make but little hay, yet it makes a fine pasture. It disappears in the winter altogether, but the first warm weather brings it up, and it grows with astonishing rapidity. On our lands and in our climate it will grow from five to seven feet high, while in South Carolina it will grow twelve feet high.

For soiling purposes it is not equaled by any grass in our knowledge, as it can be cut every two or three weeks.

There is a vast amount of land in Tennessee now devoted to gullies that would pay at least the taxes, and after a while richly remunerate the owner, if put in this grass. It is not a pre-requisite that the land should be broken up to start it. A few sprigs of the roots set here and there in the richest spots, will secure a good stand.

Many persons object to it on account of its great tenacity of life, matting the soil in every direction with its cane-like roots, and the rapidity with which it will spread over a field, and the difficulty of eradicating it. But these very objections should be its recommendation to owners of worn-out fields; and if it is desired to destroy it, it is only necessary to pasture it closely one year, and then in the fall turn the roots up with a big plow to the freezes of a winter, renewing the breaking up once or twice during the winter, and then cultivating the next spring. The seeds are quite heavy, and weigh 35 pounds to the bushel. Every one who has tried it recommends it to the public. But some allowance must be made for the partiality of friends, and it would be well to give it a trial before engaging in its culture to any large extent. There would, however, certainly be no risk in sowing it upon those worn-out hill sides, so many of which form an unsightly scar upon the face of nature in Tennessee —the tokens of the past.

CHAPTER XI.

RED CLOVER—(*Trifolium pratense.*)

The stems are ascending, somewhat hairy, leaflets oval or somewhat subovate, often notched at the end and marked with pale spots on the upper side, heads ovate and set directly on the end of the stalk. instead of being on the branches.

This valuable forage plant was first introduced into England in 1645, during the stormy times of Charles I, and rapidly met with favor throughout the kingdom. It properly belongs to the leguminous family, which includes a considerable number of other forage plants that are called artificial grasses, to distinguish them from the true or natural grasses called *gramineæ.* The botanic name trifolium comes from two latin words, *tres*, three, and *folium*, a leaf, and in England it is often called Trefoil. It may always be known by having three leaves in a bunch, and the flowers in dense, oblong globular heads.

There is no grass, natural or artificial, that is more useful to the farmer or stock-grower, than Red Clover. It has been styled, with some show of reason, the corner-stone of agriculture, and this not only on account of its vigorous vitality, but because it adapts itself to a great variety of soils. It is widely diffused, and abounds in every part of Europe, in North America, and even in Siberia. It furnishes an immense amount of grazing, yields an abundance

of nutritious hay, and is a profitable crop, considered with reference to the seed alone. But beyond all these, it acts as a vigorous ameliorator of the soil, increasing more than any other forage plant the amount of available nitrogen, and so becomes an important agent in keeping up the productive capacity of the soil, increasing the yield of other crops, and adding to the wealth, refinement and culture of the farmer who sows it.

SOILS ADAPTED TO ITS GROWTH.

Red Clover is a biennial plant, and under judicious tillage may be made a perennial, and is specially adapted to argillaceous soils, but it will grow well upon sandy soils, when a "catch" is secured, by the application of a top-dressing of gypsum or barn-yard manure. I have seen it growing with vigor upon the feldspathic soils of Johnson county, upon the sandstone soils of the Cumberland mountain, and upon the sandy loams of West Tennessee, but it finds a more congenial soil in the clayey lands of the valley of East Tennessee, on the red soils of the Highland Rim, and on the limestone loams of the Central Basin. But the deep, black, porous soils of this division are not suited for clover. Such soils become very dry in summer, and opens in great cracks or fissures. The clover grows well enough, but is apt to be killed by the dry, hot weather of summer.

The clayey lands of West Tennessee have no superior for the production of clover. It often grows upon these lands from four to five feet in height, and forms a mat when it falls, of great density and thickness. As much as four tons of clover hay have been taken from a single acre. There is also a soil derived from the Dyestone or Clinton formation in East Tennessee that grows clover with surprising luxuriance. On such soils in McMinn county, I have seen the ordinary Red Clover six and a half feet in height. Probably three-fourths of the lands in Tennessee will grow clover remuneratively, and of the soils which will not, a large portion is included in the old gullied fields that con-

stitute the shame and mark the shiftlessness of too many of the farmers. It may be set down as an infallible rule in the State of Tennessee, that good farming and abundant clovering go together.

SOWING CLOVER.

Clover may be sown in the latitude of Tennessee upon wheat, rye or oat fields, or alone. Instances have been reported to me where a splendid stand was obtained by sowing after cultivators in the last working of corn in July. This is unusual, however. So is fall sowing. The best time to sow is from the first of January until the first of April. If sown in January or February, the seed ought to be sown upon snow. This is not only convenient in enabling one to distribute the seed evenly over the land, but the gradual melting of the snow, and the slight freezes, bury the seed just deep enough to ensure rapid germination when the warm days of March come on. For the same reason, if sown in March, the seed ought to be sown when the ground is slightly crusted by a freeze. If the sowing is deferred until too late for frosty nights, the land should be well harrowed and the seed sown immediately after the harrow. Upon land seeded to wheat, this harrowing will not only serve to secure a good stand of clover, but will add greatly to the yield of wheat. It will hasten germination and cause a larger proportion of seed to grow, to harrow the land after the seed is sown. With oats, the seeds should be sown after the last harrowing or brushing, with a slight after-brushing to cover them.

It often happens when clover seed is sown with wheat or oats, especially if the land be much worn, that a "catch" will not be obtained. The practice is so universal throughout the State, of sowing clover with small grain, that many farmers labor under the impression that this is the only way of seeding land to clover. This idea is erroneous. A better stand of clover with less seed, may always be secured by sowing upon land prepared for clover alone, I have

often obtained an excellent catch upon "galled" places, by breaking the land well, and sowing the seed without any previous or after harrowing. In nine cases in ten, a stand will be secured in this way upon soils where clover sown with small grain will fail nine cases in ten.

The quantity of seed to sow per acre depends upon the character of the soil, its state of pulverization, and also upon the fact whether the land has ever been seeded to clover. Upon good, fresh, rich soils where clover has not previously grown, one bushel for eight acres will be sufficient. If the soil is thin and unproductive, one bushel for six acres ought to be sown. If the land has been regularly rotated with clover, one-half the quantity of seed mentioned above will suffice, sometimes much less. Clover seed owing to the large quantity of oil which it contains, is nearly indestructible when placed ten or twelve inches beneath the surface. I once purchased a field which had been cropped continuously for ten years without rest, and almost without any rotation. It grew a crop of corn the year before. I purchased it in February, plowed it deeply with a large three-horse plow, and sowed it in oats. The oat crop was excellent, and I never saw clover spring up so thickly upon any land. After the oats were harvested the clover grew to the height of eighteen inches, and covered the whole field with its rich mantle of green. I did not sow one seed on it, and no clover had been permitted to grow upon it from 1859 to 1869, the year I seeded it to oats.

The frequent failure to secure a good stand of clover admonishes the farmers of the State to exercise more care in the seeding. When sown late in the spring many of the seeds sprout, and are killed by dry weather. It would be all the better if the clover seed could be buried a half-inch (or even an inch on loose soils) beneath the surface after the middle of March. The common practice in England, is to sow not only clover, but all other grass seeds, with oats or barley, in spring. After the seeds are sown the field is har-

rowed and afterwards rolled, so as to cover the seeds and smooth the surface of the field. Farmers are often too sparing of the seed. While upon well prepared soils a bushel to eight acres is sufficient, yet a bushel to six acres will, in a majority of cases, give better and more satisfactory results. In England 24 pounds are usually sown to the acre when the crop is intended for hay. The smaller the stem the more acceptable it is to cattle. When thin, the woody fibre is greatly increased. There is no greater blunder committed by the farmer, than to be sparing of grass seed. It is difficult for grass to be too thick. The plants shelter one another; they retain all the dew and moisture when thickly set, and they must push upward, as there is no lateral space to occupy.

GROWTH AND MANURE.

Red Clover rarely makes much growth the first season if sown with grain. Should the weather be very seasonable after harvest, and the land fertile, it will sometimes attain the height of thirty inches and put out blooms, making an excellent fall pasture. When sown alone, it will always blossom in August.

Sheep are very injurious to young clover, and should never be allowed to run on it until the second year. Grasshoppers, too, often eat out the crown and destroy it. Dry weather in a stubble field where the rays of the sun are reflected and repeated a thousand times from the surface of the yellow stubble, is very trying to its vitality. Yet if the land has been well and deeply broken and is moderately fertile, a sufficient stand may be depended upon.

As soon as it begins to grow, in early spring, an application of two bushels of gypsum or land plaster, upon granitic or sandy soils, is absolutely necessary to get a good growth.

Some interesting experiments were made in Germany by Dr. Pincus, respecting the action of gypsum (sulphate of lime) upon clover. Three plats of land of about $\frac{3}{8}$ of an

acre each, were selected in May, from the middle of a large clover field. The plants were then about an inch high. One of the plats was manured with 128 lbs. of gypsum, the second with the same quantity of sulphate of magnesia, and the intervening plat was left without the application of any fertilizer.

On the plat treated with gypsum the clover plants soon showed a deeper green and a more vigorous growth. The clover on the unmanured plat bloomed four or five days earlier than on the manured. On the manured plats the clover was in full flower on May 24, when it was mown. The results were from each plat

	Cwt. of Clover Hay.
Without manure	21.6
With gypsum	30.6
With sulphate of magnesia	32.4

It was ascertained by a closer examination, that the increase in weight obtained from the plats manured with the sulphate did not extend equally to all parts of the plant, but was greatest in the production of stems. There were fewer leaves, fewer flowers, but more stems on the manured than on the unmanured portions. Taking 100 parts of hay the following results were obtained:

ONE HUNDRED PARTS OF CLOVER HAY.	Unmanured.	Gypsum.	Sulphate of Magnesia.
Flowers	17.15	11.72	12.16
Leaves	27.45	26.22	25.28
Stems	55.40	61.62	65.0

Or putting in another form:

ONE HUNDRED PARTS OF CLOVER HAY.	Flowers.	Leaves.	Stems.
Clover hay unmanured	17.15	27.45	55.40
Manured with gypsum	11.72	26.22	61.62
Manured with sulphate of magnesia	12.16	25.28	63.0

This shows that the action of the sulphates increased the woody fibre at the expense of the flowers and leaves. The relative proportion of flowers, leaves and stems was:

	Flowers.	Leaves.	Stems.
Clover hay unmanured	100	160	323
" manured with gypsum	100	216	507
" manured with sulphate of magnesia	100	216	538

The entire crop on each plat was as follows:

	Unmanur'd Pounds.	Manured with gypsum. Pounds.	Manured with sul. of magnesia. Pounds
Leaves	592.9	773 7	849.5
Stems	1196 6	1927.8	1996 5
Flowers	370.5	358.5	394.0
	2110 lbs.	3060 lbs.	3240 lbs

The ash constituents were increased in the same proportion as the crop. Phosphoric and sulphuric acids were much increased in quantity above the other ash constituents. The ash of the air-dry clover hay was:

	Unmanur'd	Manured with gypsum.	Manured with sul. of magnesia.
Per cent	6.95	7.96	7.94
In the entire crop	150. lbs.	243. lbs.	257. lbs.
Containing sulphuric acid	2. "	8. "	6. "
Containing phosphoric acid	11.95 "	21.55 "	21.82 "

From an inspection of these tables it will readily appear that the sulphates checked the development of the flowers and also of seed. A larger crop of leaves and stems may be secured by the application of gypsum, but not of seed, so that an application of gypsum is not favorable for the development of the seed crop, but well suited to increase the

yield of hay. Here, as is often seen in the production of wheat, the abnormal development of straw is attended with a decrease in the yield of seed.

These experiments demonstrate that the quantity of sulphuric acid applied to the field, bears no proportion to the increase in the crop. Baron Liebig, after numerous experiments made with gypsum upon clover, comes to the conclusion that the action of gypsum is very complex; that it indeed promotes the distribution of both magnesia and potash in the soil. He thinks that gypsum exercises a chemical action upon the soil, which extends to any depth of it, and that in consequence of the chemical and mechanical modification of the earth, particles of certain nutritive elements become accessible to and available for the clover plant, which were not so before.

Though having my mind constantly directed to this point, I have rarely found an application of gypsum beneficial upon clayey loams, but its effects are very apparent on strong limestone soils, such as are found in the Central Basin. On the chocolate-colored soils of Warren, Montgomery, Stewart and Robertson, gypsum benefits clover very little. Upon the soils of the Unaka and Cumberland mountains, it is indispensable to secure a remunerative yield of foliage. Red Clover has two growing seasons. It makes its most vigorous growth from the first of April until the 15th of June, beginning to bloom usually in the central parts of the State about the 15th of May, and attaining its full inflorescence about the 1st of June. After this, unless depastured by stock or cut for hay, the heads begin to dry up, and stems and leaves begin to fall, forming a mat upon the land. Sometimes this mat is so thick as to catch and concentrate the heats of summer to such a degree as to scald the roots and destroy the clover. Usually it is best after clover has attained its full bloom, either to cut it for hay or pasture with stock until about the first of July. When the stock is removed, or the clover hay cured and taken off, and

there is rain enough, a second crop will spring up from the roots. This second crop is the most valuable for seed, the seed maturing about the last of August, and sooner, if there be copious rains. To make the most abundant yield of clover for grazing, it should be allowed to grow all it will, but never let it make seed, always grazing it down when in full bloom. When grazed down, take off the stock until it blooms again. Several successive crops may thus be made during the summer. The crop of August is unfit for grazing, the large quantity of seed having the effect of salivating stock to such a degree as to cause them to lose flesh.

It is a fact, well attested by English writers, and by observant farmers of this country, that when clover has been frequently sown upon the same land, it not only fails to produce a heavy crop, but fails to appear at all. The land is then said to be "clover sick." The remedy for this is by extending the number of crops in the scale of rotation, so that clover will not come so often upon the same land. By Liebig, clover-sick land is supposed to be caused by the roots of clover impoverishing the subsoil.

Mr. Keene, of England, ascribes the failure of crimson clover in that country to the fact that only clean seed is sown. He thinks the seed should be sown in the pellicle, which acts as a protection to the young plant. The hint is worthy of a trial. Many farmers believe that fewer failures to get a catch occur when the seed is sown in the chaff.

Clover has no superior as a grazing plant. When in full vigor and bloom, it will carry more cattle and sheep per acre than blue grass, herds grass or orchard grass. After it has been grazed to the earth, a few showery days with warm suns will cause it to spring up into renewed vitality, ready again to furnish its succulent herbage to domestic animals. Though very nutritious and highly relished by cattle, it often produces a dangerous swelling called hoven, from which many cows die. When first turned upon clover, cattle should only be allowed to graze for an hour or two, and

then be driven off for the remainder of the day, gradually increasing the time of grazing, until they become less voracious in their appetites, never permitting them to run upon clover when wet. Clover made wet by a rain at midday is more likely to produce hoven than when wet by dew. This is because when wet by rain at midday or after the stalks and leaves are heated by the sun, when taken into the stomach of a cow, this heat generates fermentation much sooner than when the herbage is cool, though wet with the morning dew. Cattle are more easily affected by clover than horses, because being ruminants, they take in the clover rapidly, filling the stomach at once, without chewing. Digestion is for the time checked and a rapid fermentation sets in. The remedy found most effective for hoven is to stick a sharp pointed knife about six inches in front of the hip, to the left side of the backbone, and far enough from it to miss the spinal protuberances, and in the thinnest part of the flank. A cow should never be run when affected with hoven, as this treatment only intensifies the pain without affording relief.

Stock should never be turned upon clover until it blooms The practice of many of our farmers, to turn all the stock upon a clover field early in April, is very destructive. The crown of the clover is eaten out, causing it to perish. The tread of heavy cattle has the same effect.

As a soiling crop Red Clover is excelled by no crop grown within the State. The practice of soiling in thickly settled communities is one much commended by agricultural writers. An half-acre of clover will supply one cow throughout the months of June, July and August, if cut off and fed in a stall, while twice the amount in pasture, according to some English experimenters, will barely subsist a cow during the same period, and this will depend, of course, upon the luxuriance of the growth. Soiling (that is cutting the grass and feeding it green) is a very desirable practice, near small towns, where many persons own small

lots and desire to keep a milch cow. No other grass, perhaps, will produce a larger flow of milk.

NUTRITIVE VALUE AND CONTITUENT ELEMENTS OF CLOVER.

The nutritive value of clover was long known by feeders before chemical research demonstrated the same fact. It contains, when cut in bloom, nearly 4 per cent. more nitrogenous food than timothy, and four and a half per cent. more than blue grass. According to Professors Wolff and Knop, in its green state it contains 800 parts in 1,000, of water; about 100 parts more than timothy, and 37 parts in a 1,000 of albuminoids or flesh formers. When made into hay, cut when in bloom and well cured, Red Clover contains 134 parts in 1,000 of albuminoids, but cut when fully ripe only 94 parts. The albuminoids contain about 16 per cent. of nitrogen. Timothy hay has 9.7 per cent. of flesh-forming matter, and therefore contains less nitrogen, in the proportion of 15 to 21, than clover hay. Barley has 10 per cent. of albuminoids, Indian corn 10.7, rye 11, oats 12, clover 13.4 per cent., so that it appears clover hay will furnish more muscle-producing or nitrogenous food than either corn, rye, oats or timothy, which gives strength to the statements of many practical farmers, that a crop can be made by feeding clover hay alone to the working animals, and they will keep up under it.

Prof. Way gives the following analysis of the Red Clover when green:

Water	81.
Albuminoids	4.27
Fatty matter	.69
Heat producing	8 45
Woody fibre	3.76
Ash	1 82

One hundred pounds dried at 212 F., gives the following:

Albuminoids or flesh-formers	22.55
Fatty matter	3.67
Heat-producers (starch, sugar, gum, etc.)	44.47
Woody fibre	19.75
Ash	9.56

The analysis of clover hay made by Dr. Pincus in the course of his experiments, though differing slightly in its results from the analyses made by Wolff and Knop and Dr. Anderson, is far more interesting, because it shows the relative value in a nutritive point of view of the different parts of the plant. The analysis is given in the subjoined table:

ANALYSIS OF CLOVER MADE BY DR. PINCUS.

100 PARTS OF AIR-DRIED CLOVER CONTAINED—

	Unmanured.				MANURED WITH SULPHATE OF MAGNESIA.				MANURED WITH SULPHATE OF LIME.			
	Stems.	Leaves.	Flowers	Entire plant.	Stems.	Leaves.	Flowers.	Entire plant.	Stems.	Leaves.	Flowers.	Entire plant.
Water	12.25	13.04	15.05	12.95	13.00	14.45	12.12	13.27	11.85	10.70	12.24	11.60
Vegetable fibre	39.55	15.07	16.36	28.85	39 47	12.58	17.08	29.70	38.75	13.73	16.96	29 87
Mineral constituents	5.05	11.16	6.32	6 95	6.75	10.97	7.47	7.94	6.65	11.45	7.45	7.96
Flesh-formers	10.15	22.08	17.59	14.70	11.42	24.37	19.59	15.81	12 34	28.74	20.57	17.45
Heat-producers	33.00	38.65	44.68	36.55	29.36	37.63	43.74	33.28	30.41	35.38	42.78	33.12
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total quantities of nutritive substances	43.15	60.73	62.27	51.25	40.78	62.00	63.33	49.09	42.75	64.12	63.35	50.57
Proportion of the albuminoids to the best producers	1:3.25	1:1.75	1:2.54	1:2.46	1:2.57	1:1.54	1:2.23	1:2.10	1:2.46	1:1.23	1:2.08	1:1.90

The proportion of fat in the various vegetable products is given in the following table taken from Prof. S. W. Johnson's "How Crops Grow":

	Fat.			Fat.	
Meadow grass	0.8	per cent	Turnip	0.1	per cent.
Red Clover (green)	0.7	"	Wheat kernel	1.6	"
Meadow hay	3.0	"	Oat	1.6	"
Clover hay	3.2	"	Indian corn	7.0	"
Wheat straw	1.5	"	Pea	3.0	"
Oat straw	2.0	"	Cotton seed	34.	"
Wheat Bran	1.5	"	Flax	34.	"
Potato, Irish	0.8	"			

It appears from this table that clover hay has not quite one-half the fat of Indian corn, but having more albuminoids it has nearly 3 per cent. more nitrogenous food. Both should be fed together, the clover to give muscle and the corn to give fat. It also appears that the clover hay is richer in fat than meadow hay.

EFFECTS OF CLOVER UPON SOILS—MANURE FOR.

Numerous facts have taught the farmers of every country where agriculture has flourished, that in many cases the value of the after crop depends upon the preceding crop. In other words, a proper rotation is a necessary antecedent to successful farming. The cultivation of some crop with extensive root ramifications, will prepare the soil for the subsequent growth of a cereal. But the farmer should not deceive himself. Every crop takes away a part of the available plant-food, and the field has not increased in fertility, but the plant-food has been made more rigidly effective for the production of a crop. "The physical and chemical condition of the fields has been improved, but the chemical store has been reduced." *"All plants,"* says Liebig, *"without exception, exhaust the soil, each of them in its own way, of the conditions for their reproduction."*

A field, then, which produces more kindly after rotation, is not necessarily more fertile, but is in better *physical condition.* It has already been mentioned, that the mechanical

effects of clover upon soils is not the least among its valuable properties. The reaction rendered possible by the penetration into the soil of the long tap roots, and the effect of the dense shade upon the land have a tendency to increase the productiveness, but may not add to the fertility of the soil.

The composition of the ash of Red Clover is variable, depending upon the soils upon which the clover grows, and consists of potash, soda, magnesia, lime, phosphoric acid, sulphuric acid, silica and chlorine. Prof. Emil Wolff, of the Royal Academy of Agriculture, at Hohenheim, Wirtemberg, collected all trustworthy analyses of the clover plant, in all fifty-six, and found the average amount of ash in air dry clover to be 6.72 per cent. In the ash there were:

Potash	34.5	per cent.
Soda	1.6	"
Magnesia	12.2	"
Lime	34.0	"
Phosphoric acid	9.9	"
Sulphuric acid	3.0	"
Silica	2.7	"
Chlorine	3.7	"

The analysis of Red Clover indicates what manures would increase its growth. Sulphate of lime or land plaster, the phosphates, wood ashes, are all excellent top dressings for the clover field. Common stable manure, containing as it does all the elements of a good fertilizer, is suitable as a top dressing for any pasture or meadow.

Prof. Levi Stockbridge, of Massachusetts, has made some interesting experiments at the Agricultural College at Amherst, with mineral fertilizers, on nearly all the field crops and grasses. Making a careful analysis of each plant, he prepares formulas for fertilizers suited to the nature and constitution of the plant. To produce one ton of clover per acre more than the natural yield of the soil would be, he gives the following formula:

Nitrogen............43 lbs	in the form of	Sulph. Ammonia, 24 per cent dry salt............215 lbs.
Potash...............40 "		Muriate potash, 80 per cent. dry salt.............80 lbs.
Phosphoric acid......11 "		Superphosphate, 13 per cent. sol acid........... 80 lbs.

This is sown over the clover broadcast, in early spring, I suppose, though the time is not mentioned.

Guano is also found, on clayey soils, to largely increase the growth of clover. When used on a wheat field seeded to clover in early spring, a "catch" of clover will be secured on the thinnest spots, and grow luxuriantly. The greatest benefits from an application of guano upon wheat are often obtained in this way. A good stand of clover, however secured, is the best possible preparation of land for a succeeding crop of wheat. And this arises not only from the available nitrogen which a clover crop supplies, but from the deep and thorough subsoiling which is effected by the deep, penetrating tap-roots of the clover. They often descend to the depth of four feet in search of food, while its broad leaves "absorb carbon from the atmosphere, changing it into solid matter, and causing elements in the soil to assume organic forms, rendering them more available as food for other crops." If the soil be robbed of its fertility, the deficient elements must be added before clover will "take."

As clover derives or is supposed to derive a large percentage of the constituents necessary to its growth from the atmosphere, it is all important that there should be a good top growth. Its value as a renovator of the soil depends largely upon the quantity of the roots, and the roots will always be proportioned to the amount of top. For this reason it is better to cut clover off than to feed it off. A writer in the *American Cultivator*, speaking of this subject, says:

"Where a clover sod is desired for future grain or other crop, it will be found that the cutting of clover is generally better than feeding it off, because every leaflet upward has

rootlet downwards, and if a leaflet be taken off the rootlet will not grow, so that if sheep or pigs be fed upon the surface, the constant cropping of the leaves diminishes the under production. Always feeding the top will leave but few roots below. This was illustrated by a practical experiment on a field of clover, divided into two parts. The whole was cut in July; half was left to grow again, and the other half fed off. In October the roots of each division were dug up, carefully cleaned and weighed, with a result that showed a proportionate weight of 3,920 pounds to the acre where the clover was cut once and fed afterwards, while the part on which the clover was cut twice yielded at a rate per acre of nearly 8,000 pounds of roots. The system of cutting instead of feeding resulted in leaving two tons extra of vegetable matter, valuable in nitrogen, and which had a perceptible effect on the corn crop that followed."

The best method of pasturing is to wait until about the last of May, when the clover is in bloom, then turn on stock and pasture during the months of June and July, alternating every two weeks with other clover fields, if possible, and turning off the stock the first of August and allowing the second crop to come forward for seed.

SAVING CLOVER HAY.

The saving of clover hay is a very easy task when under stood, but to a novice it appears fraught with insuperable difficulties. The precise period for mowing clover for hay is a question about which there has been much discussion. All will agree that it should be mowed at the time when the nutritive elements—those elements which give strength and produce flesh—are at their maximum. Those who are in the habit of feeding stock find that clover cut about the time of full bloom, when a few of the seeds begin to dry up, and just as the reproductive functions are being brought into play for the maturing of seed, will, pound for pound, produce more fat and muscle than that cut at any other time. The only art in curing hay is to retain as many of the life-

giving constituents in it as possible, or to preserve it as near as practicable in the same condition in which it is cut, with the water only abstracted.

The plan generally adopted is to mow the clover in the morning and let it lie in the sun several hours until a wisp taken up and twisted will show no exudation of moisture. It is then thrown up into small cocks, say four feet in diameter and four feet high. In these, unless there is appearance of rain, it is allowed to remain for a day or two, when it may be hauled to the barn and stored away without danger of damage. Care should be taken not to let the dew fall upon it as it lies scattered by the mower. The dew of one single night will blacken the leaves and destroy the aroma for which good clover hay is so much prized.

Another plan practiced is to mow it and let it lie just long enough in the sun to wilt, and then wagon it to an open house and lay it upon beams or tier-poles, where it can receive the free action of the air. After a few days it may be packed down without any danger of fermenting. Cured in this way, in the shade, it retains its green color, is fragrant, and makes a most excellent feed. The only objection to this plan is the great amount of room under cover required for curing, and the additional burthen of hauling while green.

Another plan is to haul it up as soon as it wilts, using about half a bushel of salt to the cured ton of hay. A layer a foot or more in thickness may be laid down, over which salt is scattered pretty freely, then another layer and salt, continuing to repeat the operation until the space set apart for hay is filled. A rapid fermentation will ensue, and the hay will be cured by the heat of this fermentation, the salt acting as a preventive against putrefaction. Instead of salt, layers of wheat straw can be substituted. By using straw the clover may be put up in the field. The quantity of straw to be used in the rick or stack depends upon the moisture in the clover—the greener the clover the thicker

should be the straw. The straw will act as an absorbent, and during the process will itself be greatly increased in value as food for stock, having imparted to it the flavor and aroma of the clover plant. All the wheat straw on a farm could be utilized in this way, and the amount of manure in the farmer's barn largely increased.

Still another method of curing clover hay is the one practiced in Ireland. By this method the hay is also cured by self fermentation. Cured in this way it retains all its nutritive properties and only parts with its water. The sap vessels are by this process supposed to be expanded by the circulation of the liquid juices by heat, and the superfluous moisture exhaled. On cooling, the sap vessels contract, and thus future inner fermentation is prevented and the nutritive elements preserved. The Irish Farmers' Journal, in giving an account of this process of curing clover hay, says:

"The clover intended for hay is mown and left to lie in the swath until 4 o'clock in the afternoon of the following day to dry. Of course these swaths are twelve or eighteen inches thick. They are then raked together in small shocks which are afterwards made into larger ones, such as would require six or eight horses to draw. Two or more men are kept upon the large ones tramping them down, so as to make them more compact and induce a more speedy fermentation. If the weather is warm, fermentation will begin in a few hours, as will be known by the honey-like smell. When a proper fermentation has begun, the cocks, on being opened, will appear brownish and may be spread. After drying it may be carried to the hay loft without any danger of a second fermentation."

It should always be borne in mind that clover hay will not shed rain. When stacked out in the field, it should either be thatched or have a thick top-covering of wheat straw or other hay. The tedder is thought by many to be indispensable in saving good clover hay. Unquestionably

it is of great service, and the hay made by the use of the tedder in dry, hot weather, is superior to that made without, but good hay can be and is made by many farmers who never saw a tedder. Clover hay is more difficult to cure than hay from any of the real grasses, and this arises from the fact that it contains more water than other grasses, in the proportion of 8 to 7. For this reason also, it is more difficult to keep, being more liable to heat in the mow. It will not bear handling or transportation, and while it will always be a favorite hay for home consumption, it will never be valuable for market purposes. For horses, good grass hay is probably better than clover, because it is more digestible, and is not so liable to produce colic. On the other hand, clover is a superior hay for cattle, producing in milk cows a fine flow of milk.

The following table, compiled from analyses made by Wolff, Knop and Way, will exhibit the comparative value of clover and grass hays:

SUBSTANCE.	Water.	Organic matter	Ash.	Albuminoids	Carbohydrates.	Crude fibre	Fat, etc
Red Clover, in bloom	16.7	77.1	6.2	13.4	29.9	35.8	3.2
" " ripe	16.7	77.7	5.6	9.4	20.3	48.0	2.0
White "	16.7	74.8	8.5	14.9	34.3	25 6	3.5
Alsike " in bloom	16.7	75.0	8 3	15.3	39 2	30.5	3.3
" " ripe	16.7	78.3	5.0	10.2	23.1	45.0	2.5
Orchard grass	14.3	81.1	4.6	11.6	40 7	28.9	2.7
Timothy	14.3	81.2	4.5	9.7	48.8	32.7	3.0
Kentucky blue grass	14.3	80.6	5.1	8.9	39.1	32.6	3.1

SAVING CLOVER SEED.

It has often been a matter of surprise that Tennessee farmers have not more generally saved their clover seed. The amount of money yearly paid out for an article which is now considered a prime necessity to good farming, has been estimated to be more than $250,000 annually. Were the lands of Tennessee incapable of producing clover seed,

there would be reason for this expenditure. In point of fact, however, no section of the Union will produce, acre for acre, a larger quantity of clover seed. Three bushels per acre have often been gathered, although the usual average is about one and a half bushels.

As the first crop of clover, coming to maturity in June, will not perfect its seed, it is necessary to take off the first crop, either by feeding or by mowing for hay, and rely for the seed upon the after crop. The quantity of seed of this crop will depend much upon the weather. Should there be much rain or heavy winds, the yield of seed will be small, but when the weather has been fine and calm and the seed free from dock or other noxious seeds, the crop will be found as remunerative as any other grown by the farmer. A bushel of clover seed will weigh usually about 64 pounds, though 60 pounds is the standard bushel in market.

The second crop of clover should be allowed to stand until the husks have becone quite brown and the seeds have passed the milky state. It should then be mowed and permitted to lie upon the ground until it is well cured. After it is cured rake it up into swaths. Rain will rather benefit than injure it, making it easier to separate the heads from the haulm, which is done by passing through an ordinary wheat separator. A clover huller attachment is adjusted to the separator below the vibrator, which hulls the seeds, and they are separated from the chaff by the fan, care being taken to shut off as much air as possible by closing the sliding doors.

The crop of seed can be largely increased by mowing or feeding off the first crop of clover about the first of June, and then top-dressing with stable manure. The earlier the first crop is cut the larger will be the crop of seed. By treating the clover fields in this way, as much as three bushels of seed have been obtained from an acre. Uplands will yield more seed than bottom lands, but they should be enriched by a liberal application of manure. About the

first of September is the time to mow for seed, and the straw will thresh all the better for being exposed to the weather for three weeks. The threshing is usually done in the field, though the haulm may be hauled up after being thoroughly dry, and stacked with a good straw covering, or else stored away under shelter on a good tight floor until it suits the convenience of the farmer to thresh. Care should be taken not to run over or tramp upon the clover after it is dried, as many seeds are thus shelled out and lost. The better plan is to haul to the thresher just as soon as the straw is in a proper condition to thresh. This will save the trouble and expense of stacking.

Mr. J. K. P. Wallace, writing from Anderson county to the Rural Sun, thus describes the method in use in that county:

"We take a six or eight horse (the latter the better) power lever threshing machine, and attach to it the ordinary box, that is, such as does not have the grain-cleaning apparatus, because this would fan seed and all away. We first run the clover straw through, which takes all the seeds off and thoroughly tears up the heads. Then we plank up the (box) machinery, leaving a small opening in front of the cylinder, say six or seven inches square, and leave a smaller one at the opposite upper corner at the rear of the cylinder. Then with a small handled paddle we feed the threshed-off heads through again. The seeds are then thoroughly hulled, ready for the fanning mill. Every fifth bushel is taken by the threshers as toll. A thresher of this kind will thresh and hull from five to seven bushels per day."

With the separators, one bushel in three is taken for toll.

Some farmers prefer to sow in the chaff, believing that a better stand of clover is thus secured. Usually about thirty bushels in the chaff are considered equivalent to one of cleaned seed. Of course this will depend greatly

upon the yield of seed, and experiments ought to be made to determine the relative amount to sow when in chaff

It is a curious fact, and one, I believe, first mentioned by Mr. Darwin, that the bumble bee plays an important part in the fertilization of this plant. Careful observation will no doubt reveal the fact that the amount of clover seed gathered from a particular field will, other things being equal, be in proportion to the number of bumble bees that feed upon the flowers. In the act of feeding they gather the pollen from one flower and transfer it to the next one upon which they alight, thus acting as important agents in the fructification of the flower, and consequently in increasing the production of seed.

CLOVER AS A PREPARATORY CROP FOR WHEAT.

No question at the present day pertaining to agriculture is more deeply interesting to the farmers of Tennessee than how to increase the yield of the wheat crop per acre, for upon this depends the profits of this standard crop, one probably more generally grown in the State than any other. It has long been noted that a soil well suited to clover is generally well adapted to wheat, but not until the pains-taking investigations of Dr. Voelcker, of England, was the fact established that the clover plant, by increasing the amount of available nitrogen in the surface soil, is the very best fore-runner for wheat, unlocking, as it were, the elements in the soil necessary to a full and perfect developement of the wheat crop.

Prof. Way has established the fact that the carbonate of ammonia of rain-water and of manures are so absorbed and so firmly fixed by the soil that no free ammonia can be present in it. Neither pure nor carbonic acid water can extract this fixed ammonia from the soil. It must be extracted by the roots of plants. A plant, therefore, with extensive root ramifications, such as clover, will extract a much larger quantity than those plants with feebler roots.

The clover roots bring this ammonia or nitrogen to the surface, and on their decay these nitrogenous matters are converted into nitrates in which the wheat plant finds a most congenial food. In addition to this, the leaves formed by clover contain a large amount of nitrogenous matter, and these are dropped upon the surface, increasing the amount of nitrogen available for wheat or other crops.

A synopsis of Professor Voelcker's article on the causes of the benefit of clover as a preparatory crop for wheat, cannot fail to be interesting. Prof. Voelcker, writing in 1869, says:

It is well known to most practical farmers that if they can succeed in growing a good crop of clover they are almost certain to get a good, paying crop of wheat. You see how all agricultural matters depend upon each other. I have come to the conclusion that the very best preparation—the very best manure, if you will allow me to thus express myself, is a good crop of clover. Now, at first sight, nothing seems more contradictory than to say you can remove a very large quantity of both mineral and organic food from the soil and yet make it more productive, as in the case of clover. Nevertheless, it is a fact the larger the amount of mineral matter you remove in a crop of clover, and the larger the amount of nitrogen which is carried off in clover hay the richer the land becomes. Now, here is really a strange chemical anomoly which cannot be discarded. and invites our investigation, and it is an investigation which has occupied my attention, I may say, for more than ten years.

This clover investigation has very much interested me, but only during the last season have I been able to bring it to anything like completion, so as thoroughly to explain the strange anomoly that is presented to us in the growth of clover as a preparatory crop for wheat. The explanation is very simple though puzzling when you know not the chemical points that are involved in the investigation. I cannot deny myself the gratification of showing you a few figures that in a thoroughly chemical point of view, show that clover is the most exhaustive crop that you can possibly grow, while in a thorough practical point of view it is the most restorative crop and the best preparative crop for wheat that you can possibly grow.

Now if we examine what is taken from the land in the shape of clover, we shall find that, assuming an acre of land to four tons of clover hay, these four tons of clover hay will remove 672 pounds of mineral constituents, and not less than 224 pounds of nitrogen, which

is equal to 272 pounds of ammonia. Four tons of clover hay, the produce of one acre, must contain a large amount of nitrogen, and remove from the soil a large quantity of mineral matters abounding in lime, potash and also much phosphoric acid. Now comparing what is removed by a crop of wheat, we find that in a clover crop we remove fully three times as much of mineral matter, and a great deal more—six times as much I believe—as we do in a crop of wheat. The total, to give the exact figures, of mineral matter removed in an average crop of wheat amounts ts 175 pounds per acre.

Assuming the grain of wheat to furnish 1.78 per cent of nitrogen, and wheat straw .64 per cent., and assuming also that 1500 pounds of wheat and 3000 pounds of straw represent the average produce per acre, there will be in the grain of wheat per acre 26.7 pounds of nitrogen, and in the straw 19.2 pounds, or in both together 46 pounds of nitrogen, in round numbers equal to about 55 pounds of ammonia, which is only about one-fifth the quantity of nitrogen in the produce of an acre of clover.

Wheat, it is well known, is especially benefitted by the application of nitrogenous manures, and as clover carries off so large a quantity of nitrogen it is natural to expect the yield of wheat after clover to fall short of what the land might be presumed to produce without manure before a crop of clover was taken from it. Experience, however, has proved the fallacy of this presumption, for the result is exactly the opposite, inasmuch as a better and heavier crop of wheat is produced than without the intercalation of clover.

I believe that a vast amount of mineral manure is brought within the reach of the corn (wheat) crop by growing clover. It is rendered available to the roots of the corn crop. Clover, by means of its long roots, penetrates a large mass of soil. It gathers up, so to speak, the phosphoric acid and the potash which are disseminated throughout a large portion of the soil; and when the ground is plowed the roots are left in the surface, and in decaying they leave in an available condition the mineral substances which the wheat plant requires to enable it to grow.

Although in clover hay these manurial matters are removed in great quantity, yet the store of mineral food that we have in six or twelve inches of soil is so great that it is utterly insignificant in comparison with what remains. In other words, the quantity of mineral matter which is rendered available and fit for use for the succeeding wheat crop is very much larger than the quantity which is removed in clover hay.

But the accumulation of nitrogen after the growth of clover in the soil is very large. Even when the clover crop is insignificant, a large

quantity of nitrogen, amounting to tons, is accumulated in the surface soil, and the better the clover crop the greater is the accumulation of nitrogen. In one of my experiments I tried to determine the amount of nitrogen which is left in the portion of a field where the clover was comparatively poor, and I fonnd that on the brow of the hill in that field, (for it had a considerable declivity), where the clover was weak the amount of nitrogen per acre was 1 ton, 11 cwt., 99 lbs, while at the bottom of the hill where the clover was stronger, there being more soil, it was 2 tons, 2 cwt. and 61 lbs. Observe too, that at the bottom of the hill the wheat was always better. Now it is in virtue, I believe, of this nitrogen that the wheat grew so much more luxuriantly.

Dr. Voelcker, in his very able article, sums up the conclusions at which he arrived in the following words:

1. A good crop of clover removes from the soil more potash, phosphoric acid, lime, and other mineral matters, which enter into the composition of the ashes of our cultivated crops, than any other crop usually grown in this country.

2. There is fully three times as much nitrogen in a crop of clover as in the average produce of the grain and straw of wheat per acre.

3. Notwithstanding the large amount of nitrogenous matter and of ash-constituents of plants in the produce of an acre, clover is an excellent preparatory crop for wheat.

4. During the growth of clover a large amount of nitrogenous matter accumulates in the soil.

5. This accumulation, which is greatest in the surface-soil, is due to decaying leaves dropped during the growth of clover, and to an abundance of roots, containing when dry from 1¾ to 2 per cent. of nitrogen.

6. The clover roots are stronger and more numerous, and more leaves fall on the ground when clover is grown for seed, than when it is mown for hay; in consequence more nitrogen is left after clover seed than after hay, which accounts for wheat yielding a better crop after clover seed than after hay.

7. The development of roots being checked when the produce, in a green condition, is fed off by sheep, in all probability leaves still less nitrogenous matter in the soil than when clover is allowed to get riper and is mown for hay; thus, no doubt, accounting for the observation made by practical men that, notwithstanding the return of the produce in the sheep excrements, wheat is generally stronger and yields better after clover mown for hay than when the clover is fed off green by sheep.

8. The nitrogenous matters in the clover-remains on their gradual decay are finally transformed into nitrates, thus affording a continuous

source of food, on which cereal crops specially delight to grow.

9. There is a strong presumptive evidence that the nitrogen which exists in the air in the shape of ammonia and nitric acid, and that which descends in these combinations with the rain which falls on the ground, satisfies, under ordinary circumstances, the requirements of the clover crop. This crop causes a large accumulation of nitrogenous matters, which are gradually changed in the soil into nitrates. The atmosphere thus furnishes nitrogenous food to the succeeding wheat indirectly, and, so to say, gratis.

10. Clover not only provides abundance of nitrogenous food, but delivers this food in a readily available form (as nitrates) more gradually and continuously, and consequently with more certainty of a good result, than such food can be applied to the land in the shape of nitrogenous spring top-dressings.

I have thus given a larger space to clover than to any other grass, natural or artificial, because I believe it is the most important plant that can engage the attention of Tennessee farmers, not only valuable in itself, but preparing the land for crops that bring the highest price in the market. Upon whatever farm clover is grown in regular rotation, there will be found abundant crops, fat stock and improved husbandry. It is the main pillar of Tennessee agriculture, and it is worse than folly to attempt to make farming pay for any number of years without it. A farmer who is too poor to sow clover seed is too poor to own a farm, and however great may be his exertions (unless within reach of a large town where manures are abundant) if he does not sow clover he is doomed to a hopeless poverty.

CHAPTER XII.

ALSIKE CLOVER—SAPLING CLOVER—CRIMSON CLOVER—LUCERNE—ESPARSETTE—VETCH.

ALSIKE CLOVER—(*Trifolium hybridum*).

This species of clover was introduced into England from Sweden, hence it is sometimes called Swedish clover. It gets the name Alsike from the parish of Alsike, in the province of Upland. It is a perennial found wild throughout many parts of Sweden, Norway and Finland.

Alsike Clover, as compared with common red clover, has a slenderer stalk, narrower leaf, and paler colored flowers and foliage. The flower stalks are longer and the blossoms more fragrant and sweeter to the taste. When first open, the blooms are but faintly tinged with pink, subsequently they deepen into a pale red, and stand up. When the period of flowering passes the heads droop and turn brown. The seed pods contain three or four seeds, which are kidney shaped, and from dark green to violet color, and considerably smaller than the seeds of red clover.

This clover does not make much growth the first year, and attains full growth only in its third year. It yields less than the red clover, and has but little or no aftermath. It is hardier and sweeter than red clover, and being a perennial, is more lasting, and it makes a finer hay.

Wherever it has been tried, experience has taught that it is best to seed it down with red clover, or some grass, preferably orchard grass, for the reasons that it does not occupy the ground the first year, and is liable to fall and lodge badly if sown alone. I have noticed that it is much frequented by bees.

It does not stand the long dry summers of our latitude well, but seems to like cool, moist regions.

A Michigan correspondent of the *Western Rural*, who appears to have had much experience with it, says:

Alsike Clover is not adapted to light sandy, or sandy and gravelly soils, with porous or leachy subsoils. With good clay subsoil, it succeeds better. But it luxuriates in rich, thoroughly worked clay loam soils, rich bottom lands, prairie, and all marsh or swamp lands where they can be plowed so as to kill the wild grasses. Flowering through winter and spring does not injure it. Here it will accept the situation and display its magnificent products on the scale of five tons of finely cured hay to the acre. But mark! deeply stirred, rich, moist land, underdrained or subsoiled, or both, will only produce this burden. The chemical action of plaster is strikingly manifest on this plant. Blossoms are developed mo e or less when the plant is from eight to ten inches in height; and when three and a half feet, it is a perfect sea of bloom.

Millions of dollars may be added to the wealth of this country, especially the West, in a few years by sowing one acre this year, and gradually extending its area. For soiling cows, horses, etc., when pastures fail, it is equal or superior to green corn, and attended with much less trouble in the gathering and feeding. During the past year, I cut three crops from the same ground, standing at the first cutting from two to three feet in height; last cutting, one foot in height, as thick as it could stand, small delicate stalks, with numerous branches, and perfectly glorified with a mass of small peach-blow colored blossoms, filling the air with the most delightful and exhilarating perfume, and swarming with bees every fair day. The root is like red clover, but longer and more fibrous. The haulm is small, tender and nutritious; when well cured as it should be, in full bloom, every spear will be eaten with avidity by all kinds of stock.

There is no plant known that will produce so much good honey, butter, cheese, beef, mutton, wool and hay per acre, as this plant, not even excepting cor . In using the latter for soiling, you get only the haulm, while in the Alsike you get the haulm and a large yield of honey; and if the ground is prepared as well by deep tilth, manure, and plaster, or other fertilizers, as for corn, you will get as much by weight of the haulm.

It bears feeding to an enormous degree. I think its fattening qualities superior to the famous blue grass of Kentucky; and as it will flourish well on such soils as I have designated, from the Gulf to Lake Superior, farmers can easily divine its immense advantage to their pock-

ets. Beside, the expense of "seeding down" every three or four years is saved. It is a great renovator and disintegrator of hard, tenacious soils. Its long tap roots and numerous fibers reach deep for its pabulum, and thus loosen the soil and endure drought well. Some think there are two kinds of this clover. I think not. The difference in growth, etc., in diverse localities, is owing to the character of the soil. I never saw any but the large kind on land once covered with beech, maple, oak, bass, lever wood, etc., and I never saw any but the small kind on light, sandy, and gravelly soils. Also, on pebbly soils with calcareous debris, and good tenacious subsoil it succeeds well It is no humbug

As compared with red clover, the hay is richer by two per cent. in flesh formers—both cut in bloom. The analyses of both, as given by Professors Wolff and Knop, show:

	Flesh Formers.	Heat producing substances.	Crude fibre.	Fat.	Ash.
Red Clover....................	13.4	29.9	35.8	3.2	6.2
Alsike......................	15.3	29.2	30.5	3.3	8.3

The great difference in the amount of crude fibre is noticeable, and shows decidedly in favor of Alsike clover.

SAPLING RED CLOVER—(*Trifolium erectum*).

This is precisely the same plant as the common red clover, and is used in the same manner, and for the same purposes. The only difference in it is, that the stems being stouter, it is not liable to lodge, but will stand erect, and so be in a better condition to mow, and admits the sun to its roots better. As to which may be preferable, is a mere matter of taste or prejudice. Either is good, the sapling clover being about two weeks later.

CRIMSON CLOVER—(*Trifolium incarnatum*).

This is an annual presenting a beautiful crimson flower when in bloom. It is principally valuable as a green food, though the hay is thought to be equal or superior to that made of red clover, but being an annual it interferes more

with the operations of the farm, it being necessary to sow it as a separate crop.

An analysis of the hay cut in bloom, as made by Wolff and Knop, show:

Flesh formers	12.2
Heating properties	30.1
Crude fibre	33.8
Fat	3.0
Ash	7.2

It is said to be earlier than lucerne or the common red clover. It may be sown upon wheat or grain stubble in the fall, the land being simply harrowed and the seed sown.

Few things, it is said, in the vegetable world, presents a more beautiful sight than a field of crimson clover in full bloom. It is not grown to any extent in this State, a few bunches appearing sometimes in fields with other clover. Its chief value is in its quick return. Sown in autumn it may be mown early the succeeding spring, and so meet any scarcity of provender.

ALFALFA: LUCERNE—(*Medicago Sativa*).

Cultivated for green fodder; belongs to the luguminous family; stems erect, one to two feet high, from a long, deep root; leaflet obovate-oblong; racemes oblong; pod several seeded, linear, coiled about two turns. (Gray.)

This is, beyond doubt, the oldest cultivated grass known, having been introduced into Greece from Media 500 B. C., and the Romans, finding its qualities good, cultivated it extensively, and by them it was carried into France when Cæsar reduced Gaul. It is emphatically a child of the sun, and revels in a heat that would destroy any other species of clover. But cold and moisture are hurtful to it. On the rich, sandy lands of the South it is invaluable, and will grow luxuriantly, making enormous yields of hay. Its nutritive constituents are almost identical with red clover, but it has one property not possessed by the latter, and that is, it is a perennial. It does not stool as freely as

red clover, and therefore must be sown rather thicker. It will continue to furnish green pasturage later than red clover.

It does not grow well on any soil that has a hard pan, nor on thin soils. To secure a stand, the ground must be in a thorough state of tilth, well pulverized and mellow. A want of attention to this requisite has caused many to be disappointed in the result. But in well prepared, rich, gravelly or sandy loam, it succeeds remarkably, sending down its long tap roots many feet into the subsoil, pumping up moisture from below, and thus will thrive when all other plants are drooping. In this respect it is far superior to clover. For the latter, a suitable surface soil is of equal importance with the subsoil, but for Lucerne a suitable subsoil is absolutely necessary, as the roots are not fibrous, only rootlets shooting off from the main tap root. This tap root grows to be as large as a carrot. This enormous quantity of roots permeating the ground to the depth of several feet, necessarily prepares the land for increased production, the leguminous plants deriving the larger part of their sustenance from the atmosphere, and storing it in the roots.

So that, as a fertilizer, it stands deservedly high. The soil is not only fertilized to the amount of several tons per acre, but it is mellowed from the mechanical displacement of the soil and the admixture of decayed vegetable matter. As a preparation for wheat it is equal to clover, and for corn better. Besides, a large amount of the leaves is necessarily strewn on the ground, and it shades it effectually.

The seed of Lucerne is yellow, and heavy, when good. If brown, it has received too much heat in the mow, and if light colored, it indicates that it was saved too green. And the same precautions are necessary to be observed in regard to red clover. The time of sowing is the same with the either species of clover, that is Spring time. It should be sown in drills, and cultivated the first year, so as to keep down the weeds. It is easily smothered.

It derives its name, Alfalfa, from the Chilians. It grows spontaneously all over Chili, among the Andes, as well as on the pampas of that country, and of Buenos Ayres. The French and Spanish settlements of the Southern States adhere to it, and cultivate it in preference to all other forage plants. It would be a good addition to the farms of West Tennessee, especially in the sandy bottoms. It would also thrive upon the alluvial bottoms of any part of the State where the sun has fair play on the ground.

When properly managed, the number of cattle which can be kept in good condition on an acre of Lucerne, during the whole season, exceeds belief. It is no sooner mown than it pushes out fresh shoots, and wonderful as the growth of clover sometimes is, in a field that has been lately mown, that of Lucerne is far more rapid. Lucerne will last for many years, shooting its roots—tough and fibrous almost as those of liquorice—downwards for nourishment, till they are altogether out of reach of drought. In the dryest and most sultry weather, when every blade of grass droops for want of moisture, Lucerne holds out its stem fresh and green as in the genial spring.

Although so luxuriant in France, it will not flourish in England for the want of sun. It has generally failed in the Northern States for the same reason, superadded to the cold, while in the South it is a fine, thrifty plant. It has been fully tested in Georgia and Alabama, and has given universal satisfaction. Horses there, it is said, require no other food when not constantly engaged in work. Five tons of good hay have been made to the acre. It is estimated that five horses may be supported during the entire year from one acre of it. It is ready for the mower a month before red clover, and springs up long before the usual pasture grasses. In saving it for hay, care must be exercised, as in red clover, not to expose the plant too long to the sun, as it will shrivel and dry up the leaves, and they will be lost. The time for cutting is when it is in full bloom, as in red clover.

Occasionally it is attacked by an insect, when it begins to turn yellow, then it should at once be cut, as it will quickly dry up otherwise. Owing to the scarcity of seed, and the small amount cultivated, it is quite expensive, but the farmer can test it on a small quantity of land, and at the same time secure seed for future sowing. The first year it is apt to be troubled by the presence of weeds, but these can be easily exterminated if the precaution is observed to run the mower over it before the weeds go to seed. Afterwards no fears need be entertained on that subject.

This plant is well adapted to the use of persons living in small towns or villages, who have a small lot they wish to devote to hay for a single horse or cow. No other kind of clover or grass will equal it in quantity, while the quality is as good as the best.

On the whole, the farmers cannot do better than adopt the cultivation of this grass. It has proved, with all who have tested it, worthy of all the extravagant encomiums bestowed upon it.

An analysis shows the hay to contain:

Flesh formers	14.4
Heating properties	22.5
Crude fibre	40.0
Fat	2.5
Ash	6.4

It will be seen that in flesh-forming constituents it surpasses red clover by one per cent.

SAINFOIN OR ESPARSETTE—(*Onobrychis sativa*).

From two French words, meaning sacred grass. It is a perennial, leguminous plant, partaking more the character and appearance of the pea than clover. It has stems from two to three feet long, straggling, tapering, smooth; leaves in pairs of pointed, oblong leaflets, slightly hairy on the under side; flower stalks higher than the leaves, ending in a spike of crimson or variegated flowers, succeeded by flat, hard pods, toothed on the edges, and prickly on the sides; roots perennial, hard and woody. Flowers in July.

Experiments have been made with this grass, and though so valuable in France as to be called sacred, it has not proved a success here. It requires two or three years to arrive at maturity, and during that time has to be watched closely, or it will be choked up with weeds or grasses. It does not yield as much hay as either red clover or lucerne, but is of a very superior kind, and is much vaunted as a good butter making hay. It does not give cows the hoven, however much they may eat of it. Its seeds are also said to be superior to oats, and more nutritious, and are very fine for fowls, inciting them to lay. It does best on limestone soils, though succeeding well on gravelly or sandy land, and will stand a large amount of heat, though not much cold. It would probably suit the country further south better than Tennessee, though I have seen it growing in Stewart county, having been brought there by a Swiss family. It would probably grow on all our calcareous soils.

VETCH, TARES—(*Vicia Americana*).

Flowers, several or many on a slender peduncle; pods several seeded; with ten to fourteen oblong, and very blunt, veiny leaflets, and purplish flowers over one-half inch long.

This legumen is common throughout the whole United States, though sparingly raised in Tennessee, from the fact that the ordinary cow or stock pea answers our purpose equally well for all kinds of stock, and is a savory food for man, and on this account the latter will be treated further on under the head of Cereals, both of man and beast.

This closes the chapter on meadow grasses, cultivated or experimented with in Tennessee. There are many others which may be worthy of a trial.

PASTURE GRASSES.

PART III.

While there are over 200 varieties of grasses cultivated in England for the use of domestic animals, in the occupied territory embraced within the United States there are not more than twenty-five, although there is a much greater diversity of soils, surface configuration, climate and latitude. The grasses constituting our meadows are nearly all derived from the eastern continent, where the abundance of the rich pasture lands teem with a great variety of nutritious herbage. All the cereals—oats, rye, wheat and barley, are indigenous to the old world. Indian corn is the greatest and almost the only valuable cereal contributed by the new world to the old. The great prairies east and west of the Mississippi abound in a charming and luxuriant vegetation, but the supply of food which they afford for the herds grazing upon them in comparison to the overwhelming quantity of worthless herbage, is very scanty. Exactly the reverse is the condition of the pastures of the eastern hemisphere, where almost every plant that springs from the surface of the earth is rich in nutritive elements. The extensive plains along the eastern slopes of the Rocky Mountains, extending to the western borders of Kansas, are the only natural pastures where the growth of an indigenous grass of suitable texture and highly nutritive qualities prevails to the exclusion of almost all other vegetation. The Buffalo grass, *Buchlœ dactyloides* delicate and low growing species, but very nutritious and exceedingly tenacious of life, possesses dominion

over the entire surface. It survives equally well the severest droughts and the tramping of the buffalo. The range of this grass is said to be identical with that of the buffalo.

The western slope of the Sierra Nevada, from the upper Sacramento to San Diego, has hundreds of square miles covered with the wild oats of California. This is also excellent natural pasture grounds.

I do not pretend to say that the *poa pratensis* or blue grass, our most valuable pasture grass, is a true indigenous species. It is found over such an extensive range and often in such wild and inaccessible places, far from settlements, that it is impossible to believe that the seeds could have been disseminated by the settlers or their stock. Besides, we know of numerous other plants which belong unquestionably to both continents. It is also evident that the spread of this grass has been favored by the expanse of cultivation and the increase of stock.

It is still an open question whether, among the few indigenous grasses, there may not still be some which would submit to artificial treatment and become useful and profitable meadow, or, at least, pasture grasses. Here is a field well worthy the attention of the Agricultural Department at Washington. The numerous geological and geographical surveys now persecuted with such vigor by the General Government, should be charged with the duty of collecting seeds of the wild grasses that promise to be valuable, and skillfully conducted experiments made at the botanical gardens at Washington.

There are many other wild grasses that might be domesticated, many of which are common in Tennessee. The following furnished by Dr. Gattinger, are not rare, but very generally distributed, and good for grazing. Experiments should be tried with these under culture:

Sporobulus Indicus.
Bouteloua curtipendula.
Poa compressa.
—serotina.
—flexuosa.
—brevifolia.
Festuca elatior.
—nutans.
Bromus Kalmii.
Elymus Virginicus.
—Canadensis.
Paspalum distichum.
—læve.
—racemulocum.
—undulatum.
—ciliatifolium.

Some of these, under cultivation, might become important pasture grasses, especially the Poas.

In this part I shall treat the Pasture Grasses in the following order: Meadow Foxtail, Mexican Muhlenbergia, Nimble Will, Hair grass, Black Oat or Prairie grass, Bermuda grass, Hairy Muskit, Pointed Slender grass, Annual Spear or Goose grass, Wood Meadow grass, Wire grass, Blue grass, Rough Meadow grass, Creeping Meadow grass, Strong-scented Meadow grass, Slender Meadow grass, Meadow Comb grass, Quaking grass, Small Fescue, Sheep's Fescue, Meadow Fescue, Common Reed grass, Cane, Couch grass, Velvet or Lawn grass, Barley grass, Tall Meadow Oat grass, Wood Hair grass, Crab or Finger grass, Sweet-Scented Vernal grass, Prolific Panic grass, Pampas grass, Ramie, Fiorin, White Clover, Japan Clover, Herds grass and Orchard grass.

CHAPTER XIII.

MEADOW FOXTAIL—MEXICAN MUHLENBERGIA—NIMBLE WILL—HAIR GRASS—BLACK OAT OR PRAIRIE GRASS—BERMUDA GRASS—HAIRY MUSKIT—POINTED SLENDER GRASS—ANNUAL SPEAR GRASS—WOOD MEADOW GRASS

MEADOW FOXTAIL.—(*Alopecurus pratensis.*)

This grass has an erect, smooth stem, one to two feet high, with swelling sheaths; spikes cylindrical, obtuse, equalling the sharp, cone-like glumes; awns twisted and twice the length of the blossom. It flowers in May and June. The spikes are not so long or large as timothy, but, except as to size, it very closely resembles it. It has only one palea, and the head is soft, while timothy is rough.

What the blue grass is to Tennessee the Foxtail is to the Northern States. There it is regularly sown, and the seeds command a high price. When young, and, in fact, up to blossoming, it is eaten with relish by stock, especially sheep, but after it forms seed it is of but little service in the support of anything. It is never sown here; in fact it is rather regarded in the light of a pest by most farmers, as it forms one of the grasses to be specially contended against in the cultivation of field crops. It grows without care, almost everywhere, especially on abandoned fields, and generally, with broom-grass, roots out other vegetation. In the fall, after it has seeded, it makes a very luxuriant aftermath. The nutritive value of this grass will surprise many farmers who have always looked upon it with disfavor. According to Way's analysis, it has

in 100 parts, when green, of flesh formers, 2.44; fatty matter, .52; heaters, 8.59. When dried the same grass yielded of flesh-formers, 12.32; fatty matter, 2.92; heaters, 43.12 in 100 parts. Wolff's and Knop's analysis of this grass may be seen on page 36.

MEXICAN MUHLENBERGIA.—(*Muhlenbergia Mexicana.*)

This grass has an erect stem, two to three feet high, with a great many branches; panicles lateral and contracted, branches closely spiked, in clusters, green and purplish; glumes pointed, awnless and unequal. It flowers in July and is perennial.

This grass thrives best in bottoms, where it grows freely. It is slower in maturing than most grasses, and hence, fills a vacuum caused by the seeding and dying out of the earlier grasses. It is eaten with avidity by cattle, and is a good grass in its place. From its wonderful strength, and its rapidly spreading roots, it is not advisable to allow it to be sown or planted in gardens or fields.

NIMBLE WILL.—(*Muhlenbergia diffusa.*)

A species of the preceding; has stems diffusely branched, from eigh to eighteen inches high; panicles slender and contracted; glumes min ute; awns nearly twice as long as the palea. It flowers in August and September, and is a perennial.

It is hardly necessary to do more than mention this grass, which forms, in many sections the bulk of the pastures of the woods. It does not grow in fields, but in woods, where, in the fall, after rains have set it, it carpets the earth with living green. Various opinions are entertained as to its nutritive qualities, Some farmers contend that their stock are fond of it, and, on a sufficient range, cattle, horses and sheep will go into the winter sleek and fat from this vigorous grass. Others regard it as well-nigh worthless.

It freely propagates itself in all woods where the covering of leaves is not so great as to exclude the rays of the sun from the soil. Like other grasses, it does best on good

lands, and the rich, black, loamy woods in many parts of the State are set with it.

It is said to be an excellent butter making grass, and gives a particularly fine flavor to this article of food. It has never, to the knowledge of the writer, been sown, though, as it produces seed in a limited quantity, there is no reason why it should not be if it is really a valuable grass.

HAIR GRASS.—(*Muhlenbergia capillaris.*)

Another species of the same. Has spikelets, one-flowered in contracted, slender panicles Glumes minute; palea hairy or bearded at the base, herbaceous, the lower three nerved, pointed or nerved at the tip; stamens, three

These grasses, together with several not growing in the State, were named from Dr. Muhlenberg, a distinguished botanist, who gave them a name and description.

The hair grass is a beautiful, graceful grass, and is often sold by florists as an ornamental grass, and forms a feathery addition to bouquets. It has no great agricultural value.

BLACK OAT GRASS--PRAIRIE GRASS.--(*Stipa avenacea.*)

Spikelets one-flowered; flowers stipitate, or borne on slender stalks; glumes equal, membranaceous; pales longer than the glumes, thick and leathery, the lower tipped with a very long awn; bent above and twisted at the base; seed scale rounded or cylindrical, infloresence in spreading panicles. Perennial.

This grass is found in the fence corners of most of our fields, and, to some extent, in the woods in sandy places. It resembles very much the black oat, and hence its name. Cattle and sheep will eat it after it has seeded, but it is not of much value. It grows on almost all of the prairies of the Western States. It is often seen in vases as an ornamental plant.

BERMUDA GRASS.--SCUTCH GRASS.--(*Cynodon dactylon.*)

Glumes nearly equal; spikes, four to five; pales smooth; stems smooth, hollow, prostrate at the base, with four or five leaves flat or folded,

acute, rigid, hairy, rough at the edges; lower joints covered by the sheath; infloresence digitate, purplish; stamens three; stigmas feathery; perennial.

Bermuda grass is a native of the West Indies, and is the principal grass of that torrid country. It has only lately been brought into notice as a valuable pasture grass for this State. In Louisiana, Texas and the South generally, it is, and has been, the chief reliance for pasture for a long time, and the immense herds of cattle on the southern prairies subsist principally on this food. It revels on sandy soils, and has been grown extensively on the sandy hills of Virginia and North and South Carolina. From the extreme vitality of its long, rhizome roots, it is very difficult to eradicate when once it gets a good foothold. Occasionally the traveler meets with patches of Bermuda grass in the cotton fields of the South, and it is carefully avoided by the planter, any disturbance giving a new start to its vigorous roots. Some ditch around it, and others enclose it and let shrubbery do the work of destruction, It is used extensively on the southern rivers to hold the levees and the embankments of the roads. It is the only yard grass in that section. It forms a sward so tough it is almost impossible for a plow to pass through it. There is a saying in the South, "that it would take a team of six bull elephants to draw a thumb-lancet through it."

It will throw its runners over a rock six feet across, and soon hide it from view; or, it will run down the sides of the deepest gully and stop its washing.

The parks of the South, set with it, present a very beautiful appearance if kept mown, and its pale green color acts as a great relief to the landscape when burning with the summer suns of the South. Hogs thrive upon its succulent roots, and horses and cattle upon its foliage. It has no seed, but can be easily propagated by dropping cuttings in a furrow two or three feet apart. It, however, does not

endure a shade, and the weeds must be mown from it the first year.

In some of the worn and gullied fields of Tennessee, on her mountain sides and on the sandy hills of many parts of the State, the cultivation of this grass would be a grand improvement, making the waste places to bloom, where now only sterility reigns. During the winter it, unlike blue grass, disappears from view, but with the warming influences of the sun it springs up and affords a constant grazing through the spring, summer and autumn months. The farmers of the South, before the war, looked upon it as a curse rather than a blessing, and used every endeavor to destroy it. But a change of opinion has taken place in this respect, and it is encouraged in its growth.

It would be a good grass to mix with blue grass, as, when it disappears in the winter, the blue grass and white clover would spring up to keep the ground in a constant state of verdure. It grows luxuriantly on the top of Lookout Mountain, having been set there many years ago. This mountain is 2,200 feet high, and has, as a matter of course, excessively cold winters; so, if it thrives there, no fear need be entertained as to its capacity to endure our climate. Cattle are very fond of it, and will leave clover to feed upon Bermuda. It also has the capacity to withstand any amount of heat and drought, and months that are so dry as to check the growth of blue grass will only make the Bermuda greener and more thrifty. The experiment of mixing the two grasses, spoken of above, has been tried with eminent success.

It is also used in the South as a meadow grass, but Tennessee has so many other grasses of more value, that it would not be profitable to employ this, other than as a pasture grass.

Where it is indigenous, it has a great reputation as a fertilizer, and many fields so worn out as to be worthless, have been reclaimed by it. The labor of plowing it up is

considerable, but the many improved plows of the present day would be easily dragged through it. There is a sacred grass in India called the Daub, and it is venerated by the inhabitants on account of its wonderful usefulness. This is said to be precisely the same as the Bermuda, except the changes made by the differences of climate and soil.

Mr. Affleck, in a letter to H. S. Randall, says of the Bermuda grass:

"We are fully aware of all the objections made to the spreading of this grass, and have a practical knowledge of all the trouble it occasions; and having also had several years' experience of its great, its incalculable value, we have no hesitation in stating that the latter is many-fold greater than the former. The time is not far distant when all the rough feed consumed on plantations will be made from this grass; and when the planter will consider his hay crop as of much more importance than his sugar or cotton. The excellence of this plant for pasturage is evinced by two circumstances. It is preferred by stock of every description to all other grass, and it grows luxuriantly in every kind of soil. It possesses an additional advantage, that of binding the loosest and most barren sandy tracts. But when it has once taken possession of close, rich soil, its extirpation is so difficult as almost to defy all the skill, industry and perseverance of farmers. It is used to bind the levees on the banks of the Mississippi, and of railroads. We saw it at Macon, Ga., Charleston, S. C., and so on, as far north as City Point, Va., where it partially covers the wharf. One hundred pounds of grass afford *upward of fifty of hay;* and *we do cut*, as a regular crop, five tons of hay per acre each season. Were we to state *how much more* has been cut, we might strain the belief of our readers. No other grass will yield such an amount of valuable hay; surpass it in nutritive qualities; support on an acre of pasture such an amount of stock; will improve the soil more quickly; or so effectually stop and fill up a wash or gully.

But, on the other hand, its *extirpation*, when once well established, is almost impossible, though to check and weaken it, so far as to grow a grain or cotton crop, is easy enough. To do this, pursue the course of the best farmers of Kentucky in their management of blue grass sod—with a good breaking plow, having a wheel and coulter, and a stout team, turn over evenly and nicely a sod four inches thick and as wide as the plow and horses are capable of, following in the same furrow with another plow which casts the dirt well, and throw out as much of the fresh earth on top of the sod as possible, or the depth of the soil will admit of. The crop that follows can easily be tended without disturbturbing the sod, and its gradual decay will greatly increase whatever crop may be planted on it—and that should be a shading one, corn and peas or pumpkins, or winter oats followed by peas. Good farmers will understand that heavy crops of hay cannot be removed, for many successive years, from any land without some return in the shape of manure. To the careful, judicious farmer, who wishes to improve his land and his stock,, and who does not expect to grow any crop without trouble, and who uses good plows and keeps a stout team, and that in prime order, we earnestly recommed to try an acre or two of this grass, in a situation where it cannot readily spread. To the careless farmer we say touch it not.

"Bermuda grass well set, which affords the finest and most nutritious pasturage I have ever seen, will keep almost any number of sheep to the acre—three or four times as many as blue grass."

HAIRY MUSKIT--MEZQUITE--MESQUIT.--(*Bouteloua curtipendula.*)

Spikes short, solitary, racemed; spikelets alternate, two or three flowered, the terminal flower imperfect; glumes two; keeled, the upper layer shorter than the flowers; stamens three; anthers orange or red; rachis extending beyond the spikelets. Perennial.

Muskit grass has come into very general use in some

parts of Virginia, North Carolina, and, to some extent, in Tennessee, and where used, has given much satisfaction. It is the grass of the northern and western prairies, and is very nutritious. In the absence of grasses better suited to this climate, the Muskit might become a very popular grass, but such is not the case. Great quantities of it are annually cut and sold as prairie hay. It would be well for some enterprising farmer to experiment with it.

POINTED SLENDER GRASS.--(*Leptochloa mucronata.*)

This is an annual, growing from two to three feet high, and flowers in August. Sheaths hairy; spikes from twenty or more, two or three inches long, in a long panicle-like raceme; glumes pointed, about equaling the three or four awnless flowers.

It grows in fields and pastures and affords a small amount of grazing during the hot months; while the regular pasture grasses are parched up with heat. But it is not of much agricultural value in the presence of so many others that are successfully grown.

ANNUAL SPEAR GRASS--GOOSE GRASS--(*Poa annua.*)

Spikelets ovate, crowded, three to seven flowered; panicle one-sided often; stems spreading, flattened, tufted; lower palea more or less hairy on the nerves below; leaves of a bright green, sword-shaped, flat, often crumpled on the margin, smooth on both surfaces, rough at the edges; seeds oblong, free; glumes shorter than the flowers.

This is one of the species of the valuable genus Poa to which blue grass belongs, and is a very common grass on all our swards, and known as Goose Grass. It is so very like blue grass that, to a casual observer, it would be taken for it. But the florets are not webbed, and in blue grass the roots are creeping, while this is tufted. It is a valuable grazing grass and sows itself. It is a common pasture grass of the Northern States, and is highly prized. It flowers through the whole summer, unless dried up by a drought, to which it easily yields. It forms the principle grazing of the Unaka Mountains, in Tennessee.

According to Prof. Way, this grass is less nutritious than blue grass, when green, and more nutritious when dry. A comparison of the two when green and cut in bloom and dried is as follows:

	Water.	Flesh formers.	Fat.	Heaters.
Poa annua....................	79.14	2.47	.71	10.79
Poa pratensis..	67.14	3.41	.86	14.15

When dry, the comparison shows as follows:

	Flesh formers.	Fat.	Heaters.
Poa annua............................	11.83	3.42	51.70
Poa pratensis	10.35	2.63	43.06

The analysis of Wolff and Knop, on page 36, show a similar difference.

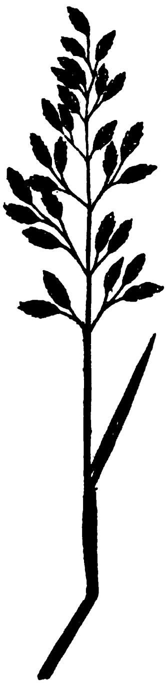
WOOD MEADOW GRASS.--(*Poa nemoralis.*)

This grass grows in moist, shady woods, is rank and luxuriant, and is, like the other Poas, greatly relished by stock. It will thrive well in thickets and barrens, and is an early grass. It has been treated of under the head of Meadow Grasses.

CHAPTER XIV.

WIRE GRASS OR BLUE GRASS OF THE NORTH—KENTUCKY BLUE GRASS.

WIRE GRASS, BLUE GRASS OF THE NORTH—(*Poa compressa.*)



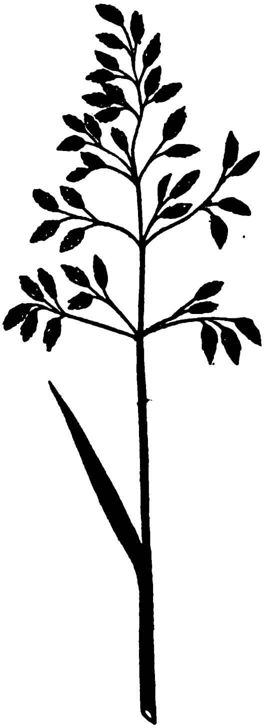
Stems ascending, flattened, the uppermost joint near the middle; leaves short, green; panicle dense and contracted, expanding more at flowering; short branches often in pairs, covered with from four to nine flowered flat spikelets; flowers rather obtuse, linear, hairy below the keel, ligule short and blunt; hight about a foot to eighteen inches.

This is the Blue Grass of the North, and it thrives on poor sandy knolls, and though the foliage is not so luxuriant as in other grasses, it is very valuable. It is found principally in the mountainous portions of East Tennesseee, though it is seen everywhere over the State. It is very hardy and, even in paths that are trodden, it does well. Its color has given it the name of "blue grass" all through the North, but it must not be confounded with Kentucky blue grass, to which it is closely allied, differing principally in having a flat stalk and a darker green color.

BLUE GRASS—(*Poa pratensis.*)

Lower florets connected at the base by a web of long, silky filaments, holding the calyx; outer palea five ribbed, marginal ribs hairy; upper sheath longer than its leaf; hight from twelve inches to two feet; root perennial, creeping; stem erect, smooth, round; leaves linear, flat, acute, roughish on the edges and inner surface; panicle diffuse, spreading,

erect. The plant is of a light-green color, the spikelets often variegated with a purplish brown color. Flowers in June and July. In addition to the name of Blue Grass it also in certain localities takes the names of June Grass, Common Spear Grass, Green Meadow Grass, Kentucky Blue Grass.



This is the king of pasture grasses in the Central Basin of Tennessee, and on soils suited to its growth it is useless to attempt the cultivation of any other kinds, except as auxiliary to this. It is valuable, both for summer and winter pasturage, and no farmer occupying soils suited to its growth is justifiable in being without it. It is easily started, and the seeds are readily procured, and once started, it is perennial. No amount of pasturing is sufficient to destroy it utterly, and, though eaten until no appearance of it is seen on the ground, with rest for a few days, the earth is again carpeted with its soft green foliage as luxuriantly as ever. "Whoever has blue grass has the basis for all agricultural prosperity; and that man, if he has not the finest horses, cattle and sheep, has no one to blame but himself. Others in other circumstances may do well, he can hardly help doing well if he will try."

Its parentage is claimed by many States, and it is probably indigenous to some of them, though some authors say it was introduced from Europe. Let that be as it may, it grows readily in all parts of the United States north of latitude 40°, and lower down on suitable soils. It flowers in earliest summer, and gives a rich pasturage, except in the dryest months, all the year. It varies in size in dif-

ferent localities according to soil and climate. From the unexampled success its cultivation has met with in Kentucky, it has acquired the name of Kentucky Blue Grass, though in the New England States it is known by the name of "June Grass."

In all the middle portion of the United States, it forms the principal constituent of the turf, though its excellence is rather depreciated in the Eastern States, the farmers there prefering the Meadow Foxtail, and in England it is almost driven from the country, the moist condition of the land there not being favorable to its development.

In some sections it has been used as a hay, and from the analysis hereunto appended, it is full of all the constituents of nutrition. But it is not a success as a meadow grass, its chief excellence being exhibited as a pasture grass. It endures the frosts of winters better than any other grass we have, and if allowed to grow rank during the fall months, it will turn over and hide beneath its covering the most luxuriant of winter croppings. Many farmers pass their stock through the entire winter on it alone, feeding only when the ground is covered with snow.

As a lawn grass, it stands pre-eminent among all others, its rich Paris-green foliage, its uniform growth and its constant verdure making it beautiful both summer and winter.

It would seem a work of supererogation to try to argue as to the advantages of cultivating this grass. All know its benefits, and all see around them the great increase in the value of the land covered with it. It requires but little expense to secure a stand, and little time and then the reward comes. A farm well set in blue grass will yield at least $10 per acre in grazing, and yet men who have farms with all the constituents necessary to produce the best of grass will persistently wear it out in cultivation from year to year, with less net receipts by far than the yield of a pasture.

In the work on Wheat Culture, issued from this office, it has been shown that a large proportion of Middle and East Tennessee abounds in limestone rocks, in fact, it underlies the basin of Middle Tennessee and forms most of the foundations of the Eastern mountains. The Blue Grass of Kentucky is made from soil produced by precisely the same strata of rocks here seen. Any farmer having land showing an outcrop of limestone, may be assured he has the necessary soil. These rocks are looked upon as a curse; yet, without their preseuce, we could not have the magnificent parks of blue grass seen around

Never was a time more propitious than the present for securing a fine blue grass farm. The depreciation of the price of land is unequalled in our time. Its intrinsic value is as great as ever, and farms, favorably located, can now be bought for from ten to twenty-five dollars per acre, that would, after being stocked with this grass, bring from forty to fifty dollars per acre. Our hillsides are the best for it, as the crumbling debris from the degradation of the rocks, carried down by rains, will be a perpetual top-dressing to the pastures. Besides, a dry, rich soil is better suited to its production. No level country could produce so continually good blue grass, from the simple fact, it could not receive regular supplies of lime as a stimulant to the soil.

These lands do not exist everywhere in the United States, and that should increase their value. They will be in demand, and that soon. The tide of immigration is already set towards us, and the thrifty sons of the North will readily see the great advantage of these limestone soils and secure them. The wild grasses that now are such an attraction to immigrants, on the table-lands of Tennessee, will ultimately be exhausted by the increase in population, while the demand for food and every variety of domestic animals will be proportionably augmented according to the great increase of the population. Then every acre of land that will produce Blue Grass, will be in active demand and will be de-

voted to stock raising, for which it is so well adapted, and sheep and cattle will then truly fleck every hillside.

The fame of Kentucky Blue Grass is so great, that the majority of people suppose Tennessee cannot produce as good, and they demand practical evidence of the fact. We have that very evidence here spread out before our eyes in the magnificent pastures of those, who have adopted the proper management. Kentucky has famous pastures, because in the outset of her cultivation of the Blue Grass, a system of management was adopted that proved a success, and others seeing it, also adopt it, and all who will now follow this plan will meet with the same remunerative return. That system has been thoroughly tested both in Kentucky and in some counties in Tennessee, and no one has made a failure that has attempted it. Those who have put themselves to the trouble of learning that system, and putting it in practice, have made as good grass as can be made in Kentucky or elsewhere. As in other crops, the quantity and quality of grass are in exact proportion to the care and management bestowed upon it, and the sod is as good, the blades as wide and long as can be seen anywhere; but this all depends on the skill and attention of the farmer. Some will sow a lot and then put in cattle, horses, sheep and hogs to keep it eaten to the ground throughout the year. Under such treatment the grass disappears, and such farmers conclude their soils are not adapted to grass. Let the grass get a vigorous start. Protect it from stock for the first year, and fertilize it with stable manure, or some of the superphosphates, and be sure not to over-crowd the pasture with stock. This is the true secret of having good pastures.

The question may pertinently be asked, if our State can bring as good Blue Grass as Kentucky, why is there not good pastures here as well as there? Why is not every acre in Tennessee capable of producing it, set down with this magnificent bounty of nature's hand? Most farmers believe

it will grow here. They cannot but know it, for in almost every neighborhood there is one or more luxuriant pastures; and further, they know they are very profitable to their owners, and lend a charming fascination to the landscape. Every farmer knows what a convenience it is to have a Blue Grass pasture, and when its value is considered, it is difficult to account for the fact why there are so few. Many a farmer has land suited for it, possibly so rocky, it is not worth anything for cultivation, and thinks every year that he will set that rocky lot down in Blue Grass, and yet he waits and waits, year after year, and is still found making the same resolution after the time of sowing has passed. There is no excuse for this delay. When the sowing time arrives one has a job he wants to finish, and when he is through that he imagines it is too late. Another has not the money to spare for the seed, yet all are going to sow, and thus procrastination keeps in sight the rocky, fruitless slopes instead of having them with a green sod of Blue Grass to contrast with the lichen of the rocks, and crowd its green spires in every crevice, to supply nutriment to hungry sheep and cattle.

It may seem that it is so costly, many will not make the effort. One man has a large farm, and to get a stand over the whole, it would really cost a considerable sum, and so he cannot make up his mind to spend that much at once, but rather than sow one lot one year, and another lot another year, he waits until he can sow all at once, and that time never comes.

But if the farmers will watch the system of managing Blue Grass and learn it from those who have succeeded, they will soon become so enthusiastic that every acre, capable of producing it in Tennessee, will be seeded, and we shall have a country as beautiful as the world-wide famous Blue Grass-region of Kentucky. It may be interesting to know how and when that region began the cultivation of it. Dr. F. H. Gordon, of Smith county, early became impressed with

its importance and visited the neighborhood in which its culture began, for the express purpose of investigation, and here is the result of his visit:

"Some seventy years ago, says Dr. Gordon, writing in 1871, two young men, named Cunningham, came from the south branch of the Potomac, in Virginia, to Strode's creek, in Bourbon county, Kentucky. They had studied and practiced the Blue Grass system on the Potomac. They jointly purchased two hundred acres of land on Strode's creek, and sowed the whole tract in timothy and Blue Grass. In a few years their whole tract was covered with a luxuriant coat of grass. They had brought with them the seed, on a pack horse, all the way from Virginia. Their farm soon attracted the attention of their neighbors, who began to visit and learn how to manage grass. In 1835, I too, went to see the Cunninghams and many other farmers in the Blue Grass region, in order to learn the system. I devoted many weeks to the study of the system—going with the best farmers over their farms and seeing their management; asking many questions and writing down their answers. Then the Cunninghams, like many others, had grown to be wealthy on the profits of the Blue Grass. One of them, Robert, then had two thousand acres in Blue Grass and Isaac had three thousand. Nearly all the farmers I visited, owed the luxury of their Blue Grass to the direct instruction of the Cunninghams. To me it was a feast to travel over and view the fine sod of grass on the first two hundred acres which had caused the whole Blue Grass region to become so beautiful, prosperous and wealthy.

While learning the Blue Grass system, I saw in every neighborhood that those who had studied the system closest, had the best pastures invariably. You can see in all that region of Blue Grass, some farms where all the lots look like some of ours in Tennessee, which are gnawed all the year round by calves, sheep and geese. This is because the owner does not think enough about its management.

He does all the work and incurs all the expense necessary to make the richest pastures and then wastes it all by bad and thoughtless management. But there are some farmers in almost every county in Tennessee, who well understand the Kentucky system. Those who intend to sow grass may learn the system from them. What a scene of comfort, beauty, luxury and wealth, will this whole Middle Tennessee present, when it shall be covered with the richest Blue Grass! Such will be the future of this fine country."

"Much has been published lately about immigation. But in justice to our own Tennesseeans, who own this valuable soil, I will say that we can ourselves sow all our valuable hills with Blue Grass, without the aid of labor from abroad. We do not need many laborers to make grass. It will always pay a good profit. Every acre will pay its taxes and a good profit besides. We now till too much land. We ought to till less and make more grass. Let not an acre be idle. There is our true interest. We need grass more than voters or laborers. Cotton, tobacco, rice, hemp and sugar need laborers, but grass does not. If we sow our lands in grass we can do without so much labor. The indisposition of farmers to take advantage of experience, is shown in the following case, which is in point:"

"I know a rocky lot of about six acres which I myself sowed in 1835. During last year (1870), it afforded a profit to the present owner of full ten dollars per acre. The owner has no grass on the balance of his land, and does not intend to have any. He has lived, during his whole life, in sight of rich pastures of Blue Grass, and knows that his whole tract will produce as good grass as those pastures. Yet he will not sow grass. The reader will say that this farmer, with his six rocky acres of Blue Grass, is a singular man. But he is not very singular. Because hundreds of farmers here know just as well the value of Blue Grass as he does, and yet they do not sow it. Doubtless many readers know it as well, and yet do not sow. They know,

too, that it is very profitable, still they do not make the pastures. Why? Why? Why? Will every reader who has no Blue Grass answer? Yes, many of them have answered me hundreds of times. One is not ready just now. Another cannot spare the money to buy seed. They are all going to sow when they get ready. I know some farmers who have been, for thirty years, going to sow grass before long, and the time has not yet come for them to begin."

"Again comes up the seemingly meddlesome question, why? I will give the true answer. Our farmers have as much intelligence as farmers anywhere; but *they do not sow grass, because they do not understand well the system of management.* They have not studied it in good earnest. Therefore, they do not know how little labor and expense are necessary to get a stand of grass. Their own reasoning teaches them wrongly, that the making of grass is a big and costly process; therefore, they slowly undertake it. If they knew how little labor and expense will set a large tract in grass, they would not delay one instant. If they will decide in their own minds that they do not understand how to make grass, and will apply to those who understand it, then they will all learn, that they are able, and have time enough to set their lands in grass. Then they will do it speedily."

"They must first learn how to get a stand. Then they must learn how to manage, so as to make a dense and profitable sod. It requires much more thinking than expense and labor to make good grass. Those farmers who have well studied the Blue Grass system, and have themselves covered their lands with rich pastures, can, and will freely instruct all who may apply to them to learn the system. If our farmers here will do as the Kentuckians did, they will all soon have plenty of good grass."

We cannot but commend the above sensible extract from this eminent writer on agriculture, to the attention of all readers. And if the traveler will notice, as he passes through

Smith county, from Lebanon to Carthage, he will see, on every side, the result of his teachings and example. In order to give point to the foregoing remarks, we will now proceed to treat on the best plan to secure a good stand of Blue Grass, and in doing so, will not be governed only by our own experience, but also by our observation of the success of others.

BLUE GRASS LANDS.

It is generally conceded that the lands most productive of Blue Grass are the calcareous soils. Lime is a natural stimulant to it, and it flourishes best where natural supplies of this salt are found. Go into a pasture that has an occasional out-cropping of limestone and the sprigs of grass, surrounding the rock will be found more luxuriant than anywhere else. Our lower silurian formation then, where-ever found, may be safely sown in this grass. The Basin of Middle Tennessee, the mountains and valleys of East Teneseee, and the black alluvial deposits of the rivers of West Tennessee being supplied with lime from the sources whence the streams flow, are all well suited for this grass. It also grows upon many places amongst the hills of the river, though not so luxuriantly as in the black loams of the silurian and devonian formations. Lime, though a great stimulant to its growth, is not an essential ingredient in the soil. It grows on the sandy hills of Alabama and Georgia, but not so rank as on limestone soils. Blue Grass will always grow well under walnut trees.

We have in Middle and East Tennessee the same character of soil that exists in the Blue Grass country of Kentucky, and, owing to our milder climate, can produce a better winter pasturage than can be produced in the colder climate of Kentucky. Little land exists in Tennessee but what will produce this grass profitably.

Select the lot to be sown, and clean off all brush, leaves and briars. If it cannot be done with a stalk-rake, use hand rakes, as the seed must come in contact with the soil. Seed

sown on a bed of leaves will soon germinate, but the rootlets, being unable to burrow in the soil, will quickly parch up and die. If the land is thickly covered with trees, it will not thrive well, therefore, it is necessary the timber should be thinned out. Leave the tallest trees that are really the more valuable, taking off the low, bushy kinds that make too much shade. It is an admitted fact, that Blue Grass does better in partial shade than when there is none. It does not endure a drought as well as some other grasses, and consequently some degree of shade is essential to protect it from the scorching rays of midsummer.

TIME AND MANNER OF SOWING.

So many seasons have been recommended as the proper time of sowing, that it may be said each one, under favorable circumstances, is a good time. One Kentucky farmer says: "Any time in the winter, when snow is on the ground, sow broadcast from three to four quarts of clean seed to the acre. With the spring the seeds germinate and are very fine and delicate in the spouts. No stock should be allowed for the first year, nor until the grass seeds in June for the first time, the second year. The best plan is turn on your stock when the seeds ripen in June. Graze off your grass, then allow the fall growth, and graze all winter, taking care never to feed the grass closely at any time."

Another authority says: "Follow nature and obey her dictates. The seeds ripen in June, and are scattered by the winds and rains as soon as ripe, and therefore, sow your seeds as soon as they can be gathered."

This plan might be a proper one in a colder or moister climate than ours, but here it would result in the grass being often dried up by the drought that are almost invariable in the latter part of summer.

Many sow, as stated in the above quotation, on winter snows, and that is a very good plan, but care should be

observed to have the ground free from leaves before the snow falls.

There are others who sow in the latter part of February or first of March, and this sometimes does as well as any provided time is given for the grass to get sufficient hold to resist the withering effects of the summer's drought. The main care to be taken, is to get the grass large enough to live through freezing or dry weather. It will resist the effects of frost better than heat however, and taking this into consideration, the most approved time of sowing is in the latter part of August or first of September. If sown at this time the autumnal rains will germinate the seed, and besides, at this season there is comparatively little trash on the ground, the leaves having not yet fallen. The ground being prepared, the seeds are sown broadcast, at the rate of one bushel per acre, and the sower should be followed with a harrow, or if the ground is very loose, with a stiff brush. This will give them a sufficient covering. It is a fact, demonstrated by actual experiment, as shown in one of the tables herein contained, that grass seeds will vegetate best at a depth of one-quarter of an inch. It may be supposed that, with no more covering than will be given by a harrow or brush, a great many seeds will be uncovered. This is very true, but in one pound of Blue Grass seeds, (clean seed) there are 3,888,000 seeds. By a computation every square inch of surface contains from ten to twelve seeds. With this amount on the surface, one scarcely need fear a stand, when, if one or two take root, there will be in a year an excessively close turf.

There can be but little difference of opinion in regard to the treading of stock after sowing. All writers and farmers agree, that for one year, at least, it should be kept from all stock. After that, there is some difference.

Dr. Gordon, who, as before stated, paid more attention to it than any one else in the State, adopted a plan of management that has been repeatedly tested, with uniform success. It was this:

He sowed, either in the autumn or spring months indiscriminately, as suited his convenience. He usually sowed with rye, wheat, or barley, if sowed in an open field, but if in a woods lot, he sowed with rye, or after a crop of millet. At any rate, the soil must be well cleaned off and broken up, as well as the nature of the land permits, then after the grain is sown the land is harrowed, and if possible, rolled. After this, the grass seeds were sown and brushed lightly. Immediately afterwards all the cattle, horses and sheep were turned in that could be secured. If there was not enough on his place he borrowed his neighbors' stock, and let them run on it until the ground was well packed all over the surface, and then, and not until then, were they removed. If after millet, (and that is greatly recommended, as it destroys more effectively than anything else all weeds,) harrow about the first of September thoroughly, sow the seed, brush as before, and then turn on the stock. If it is desired to sow in the spring, in the latter part of February or early in March, if not practicable sooner, harrow the grain field, the ground having been well prepared in the fall sowing, sow the seed and then turn stock on the wheat, rye, or barley, as the case may be. Oat land may be sown in the same way. The treading of the stock packs in the seeds and prevents the grass from drying up in the summer heats, or freezing out in frosts. Dr. Gordon considered an open, loose porous surface, to be unfavorable to the safety of the young grass, but if packed as directed, the grass will quickly spring up, get a firm hold, and the loose condition of the subsoil will favor the transmission of the roots to a good depth.

The after treatment is simple, and that is to allow no stock on during the first year, but as soon as the seed stalks begin to shoot up the next year, pasture it so closely that it can not go to seed.

Dr. Gordon differs in this respect from other authors, who allow it to seed one time for purposes stated below. He

would not let it seed at all. His great success in this branch of agriculture will, in every country where he is known, give weight to his authority.

Others say no stock should go on it for at least two years, or at least until after the first seeding, which will take place in June of the second year. Some of the best Blue Grass lots in Middle Tennessee have been started by following either of the above plans. Of one thing, there cannot be a doubt, and that is the ground should not be well broken up. On the surface it should be as firmly packed as possible to secure a perfect stand and form a perfect turf. When the surface is too loose, the grass easily dries up, and is much easier frozen out, the seeds not going into a germinating depth. Under favorable weather, seed sown in the spring on a crop of oats, will do as well as fall sowing. What is meant by favorable weather, is that no unusual dry weather supervenes. But there is always the risk of meeting with unfavorable weather in spring sowing, and on that account we would recommend sowing in autumn. But it is better the sowing should take place as early in the fall as the weather will permit, or, indeed, the latter part of summer, if there is a proper degree of moisture in the soil. Some farmers sow a limited amount of seed daily and over the same surface sprinkle shelled corn, then turn on their hogs. They root in search of the corn and thus plant the seed, doing the work of plow and harrow. This, to say the least, is a slovenly plan, and though possibly securing a good stand the ground is so roughened, it can never make a beautiful pasture.

If the land is loose as some soils are, it will answer a very good purpose to scratch up the surface well with a sharp toothed harrow, and this is especially the case where the roots of undergrowth exist to a great extent.

AFTER TREATMENT.

Of one fact, there cannot be a doubt, and in this lies the whole secret of having remunerative pastures of Blue Grass,

and that is, do not pasture it to death. It is true, it will stand almost unlimited grazing, but there is a point beyond which it will cease to be profitable, and that limit should never be passed. The better plan, is to have the lots divided, and allow the stock on one until it is cropped down, and then, when no longer any pickings can be taken from it, do not allow the stock to continue to tread it, simply to have them on a grass lot. It will not only do the stock no good, but, by constant tramping, the grass is unable to throw up any foliage, and in time it will die, for the roots must draw some nourishment from the atmosphere, or they will perish. Allow the grass to recuperate, by changing the stock from one pasture to another, and *never over-stock it.* Grass that will keep ten oxen in growing order, will fatten five oxen quickly. Stock of all kinds are constant feeders, and there should always be forage enough to enable them to get plenty to eat without the labor of hunting for it.

There is much variety of opinion on the amount of stock that ought to be put on an acre. This arises from the difference in the capacity of the land, some soils being rich, dry and porous will stand much heavier grazing than others. It is safer to err on the safe side, and it is better to put in too few than too many. If stock are fattened quickly, they are more remunerative than when fattened slowly. Then, when one lot is sold out, they can be replaced by others. Ordinarily two acres of good grass are requisite for one three-year old ox, and what will fatten one ox will fatten ten head of sheep.

Blue Grass should be allowed to go to seed once or twice, or until the ground is well set or turfed over, and then never more. It is a grass that propagates itself by its creeping roots or rhizomes, and it is the disposition of all plants and animals to lose vitality in the process of reproduction.

Though perennial, this habit is upon it, and though it does not actually die, its vitality is so lowered by the effort, that it lies dormant for some time afterwards, before start-

ing again its vigorous growth. Stock should be kept out at seeding time, or before, in fact, so as not to eat down the seed stalks, as they will do.

It sometimes happens that dry weather sets in during the summer months, and the grass becomes so dry it will burn. Still stock will greedily eat it. The grass having dried full of nourishing juices, it is equal to the best of hay, and stock will still fatten upon it unless the dried grass has been drenched with rains.

The fall growth of some lots should be kept untouched by stock, and in this way, a fine winter pasturage will be secured. The grass will get high enough to fall over and protect the surface foliage, and stock will keep up their flesh on it during the winter without feed. When snows fall, cattle will require to be fed, but horses, mules and sheep will paw off the snow, unless it is too deep, and get at the grass. It is the first deciduous plant that puts forth its leaves in the spring. Good fat lambs can be sent into the market earlier than from any other grass. It makes milk rich in butter, and gives the latter a fine golden color, without changing its taste, or, like clover, imparting its peculiar flavor to it.

The following is an analysis of this grass as compared with some other well known grasses: (Way.)

1ST. DRIED AT A TEMPERATURE OF 212°.

100 PARTS OF	FLESH FORMING PRINCIPLES.	FATTY MATTERS.	HEAT PRODUCING PRINCIPLES.	WOODY FIBRE.	ASH.
Blue Grass give	10.35	2.63	43 06	38 02	5.94
Timothy........................	11.36	3.55	53 35	26.46	5.28
Orchard Grass..................	13.53	3.14	44.83	33.70	5.31
Clover........................	22.55	3.67	44.47	19.75	9.56
White Clover..................	18 76	4.88	40.04	26.53	10.29
Sweet Scented Vernal...........	10.43	3.41	43.48	36.36	6.36

2ND. AS TAKEN FROM THE FIELD IN BLOSSOM.

WITHOUT DRYING 100 PARTS OF	WATER.	FLESH FORMING PRINCIPLES.	FATTY MATTERS.	HEAT PRODUCING PRINCIPLES.	WOODY FIBRE.
Blue Grass give..................	67.14	8 41	0.86	14.15	12.49
Orchard Grass....................	70.00	4.06	0.94	13.80	10 11
Timothy..........................	57.21	4 86	1.50	22.85	11.32
Red Clover.......................	81.01	4.27	0.69	8.45	3.76
White Clover.....................	79.71	3.80	0.89	8.14	5.38
Sweet Scented Vernal............	80.85	2.05	0.67	8.54	7.15

Wolff and Knop's analyses differ some from these, as will be seen by referring to page 36.

It will be seen from these tables that Blue Grass ranks close up to the best and most popular hay grasses cultivated in Tennessee, and is about equal to sweet scented vernal grass, which stands at the head of the pasture grasses in the Eastern States, but is not really so productive as the former.

There is, in all pastures, a number of bare spots that seem to resist the efforts of Blue Grass to sod. By mixing other seeds with the Blue Grass, these spots can be made to produce as well as other places. In a natural meadow, by careful counting, several species are often found growing intimately on every inch of earth. A table found elsewhere details the result of an actual count, and it is there seen that on a good natural pasture in one square foot of sod, there were 1,000 plants, consisting of twenty distinct species. This is nature's own arrangement, and may safely be copied. In such a pasture not an inch of surface is unoccupied. It may be thought an inch or two here and there, makes but little difference in the space occupied. But every blade of grass is of some importance, and it is astonishing the aggregate of these barren places. Below is a table of seeds that is respectfully recommended to those wishing to start a good pasture.

MIXTURE FOR PERMANENT PASTURE.

Orchard Grass flowers in May and June................	4	lbs.
Sweet Scented Vernal flowers in April and May.....	2	"
Sheep Fescue flowers in May and June.................	4	"
Herds Grass flowers in June and July.................	4	"
Blue Grass flowers in May and June....................	8	"
Italian Rye Grass flowers in June........................	4	"
Red Clover flowers in May and June....................	6	"
	32	

This mixture is enough for one acre of ground and none too much. Remember the old adage: "He that sows sparingly shall reap sparingly." It is better to sow too much seed than too little. If too much the weaker sprigs will die and the grass will soon accommodate itself to the capacity of the soil, but if too little is sown, it will require years for the pasture to be sodded, and the owner will be lying out of the use of so much soil during all that time. The wisdom of this mixture is seen at a glance by examining its several constituents. The blue grass, orchard grass, fescue, vernal and rye grass will be permanent. The clover takes possession first and affords for two years an immediate pasture or meadow, as may be desired. By the time the clover gives out, the grasses have a fine foothold. In the Northern States farmers invariably mix white clover with their seeds, but iu Tennessee this is unneceesary, as that valuable forage plant comes up as it were spontaneously every where. And, though many farmers are prejudiced against white clover, no more valuable native forage plant exists in Tennessee.

Now, once more, let it be urged on the farmers of Tennessee to look into this matter of pastures, and provide themselves with this highly important adjunct to every farm. No home is complete without pastures, and yet there are many who will depend either upon the fortuitous wild grasses for grazing, or feed from the crib, their stock all through the year. With a rich Blue Grass lot, no stock need be fed, except while at work, and, indeed, it is sometimes the case

that in dry, scarce years, crops have been made with horses and mules, that had no other provender than a Blue Grass lot.

ROUGH MEADOW GRASS—(*Poa Trivialis.*)

Culms roughish backwards, leaves rough edge, the lower elongated; ligules long, pointed; panicles dense lance shaped spikelets subsessile, two to three flowered oblong acute, five veined, flowers in May and June in the latitude of Tennessee.

This is a perennial, and to the common observer, very much resembles blue grass. In the North it is a common meadow and pasture grass, mixing well with orchard grass, making twice as much when mixed with other grasses as when sown by itself. It delights in shady places, and is admirably adapted to wood pastures and the banks of streams. It stands tramping as well as herds grass, but will not bear cutting, as the exposure of the roots to the sunshine soon kills it. The seed weighs fifteen pounds to the bushel, and two-thirds of a bushel is amply sufficient for an acre.

Cattle are very fond of it, preferring it to almost any other grass. Way's analysis of it cut in flower, shows the following result: Water, 73.60; flesh-formers, 2.58; fat, 0.97; heat-producers, 10.54; woody fibre, 10.11; ash, 2.20. Messrs. Scheven & Ritthausen's analysis shows: Water, 78; flesh-formers, 2.3; fat, 0.8; heat producers, 8.4; woody fibre, 8.8; ash, 1.6. Wolff and Knops' analysis may be seen on page 36. Woburn experiments by Sinclair gave 7,486 pounds per acre cut in flower; loss in drying, 5,246 pounds; nutritive matter, 233 pounds. Cut in seed produce of one acre, was 7,829 pounds; loss in drying, 4,304 pounds; nutritive matter, 336 pounds. The produce of the aftermath was 4,764 pounds and 223 pounds of nutritive matter. The chief destinction between this and the blue grass is, that the blue grass has a wooly web which entangles the seeds, making it difficult to sow them. In the Poa Trivialis the seeds are comparatively free. We have spoken of it under the head of Meadow grasses, though it is far better for the pasture.

CHAPTER XV.

CREEPING MEADOW GRASS—STRONG-SCENTED MEADOW GRASS—SLENDER MEADOW GRASS—MEADOW COMB GRASS—QUAKING GRASS—SMALL FESCUE—SHEEP FESCUE—MEADOW FESCUE, AND OTHER FESCUE GRASSES—COMMON REED GRASS.

CREEPING MEADOW GRASS.--(*Eragrostis reptans*)

This is an annual grass; flowers in July, and grows eight to eighteen inches high. It has short, nearly awl-shaped leaves, smooth, long spikelets, loose sheaths, slightly hairy on the margin; panicles from one to two inches long. It has long, creeping roots.—*Flint.*

It is very common in open pastures and fence corners, and is relished by stock; but, being an annual is not worthy of being sown.

STRONG-SCENTED MEADOW GRASS.--(*Eragrostis Poæoides.*

Another species of the same genus is this grass, with flat and smooth leaves; lower sheaths hairy, spikelets containing from ten to twenty florets, of a lead color, and flowers in August. Found mostly on road-sides and in old gravelly fields. It has a strong, disagreeable smell but handsome in appearnce.

SLENDER MEADOW GRASS.--(*Eragrostis pilosa.*)

Large, loose, pyramidal panicle; spikelets from five to twelve flowered, of a purplish lead color; glumes and lower palea obtuse; grows from six to twelve inches high.—*Flint.*

This, like the former, is found in old fields or sandy barrens. It is one of the grasses occupying the "barrens," and serves a good purpose in sustaining cattle in these unoccupied places. It is also cultivated in gardens, like the preceding, as an ornament for bouquets. Annual.

MEADOW COMB GRASS.--(*Eragrostis pectinacea.*)

Panicles widely diffuse; spikelets flat, five to fifteen flowered, purple; glumes and flowers acute; lower pale three nerved; leaves rigid, long and hairy. Perennial. —*Flint.*

This is also a species of the same with last two, and, like the others, forms a large constituent of the barren and mountain grasses. When dry it is the sport of the winds.

The importance of these great natural pastures has never hitherto been appreciated in Tennessee, but it has been the constant effort of this bureau to call the attention of stock-raisers, and especially sheep husbandmen, to the importance of these highway pastures for the economical rearing of sheep.

QUAKING GRASS.--(*Briza Media and Maxima.*)

Glumes roundish, unequal, of a purplish color; spikelets many-flowered, heart-shaped; lower pale roundish, entire, upper pale smaller, egg-shaped, flat; leaves flat; stamens three.—*Flint.*

As seen in the name, there are two sizes of this grass, one larger than the other. It grows wild in the mountanious parts of the State, but is chiefly seen in gardens, where it is cultivated for its beauty, making, with its heart-shaped spikelets, a fine addition to bouquets, for winter vases. The slightest movement causes it to shake, making a noise like the rattles of a rattlesnake. The Briza *Media* is perennial, but the Briza *Maxima* is an annual. Cattle eat it with relish, but it is a poor pasture grass, and is only suited to very sterile soils. Mr. Sinclair ascer-

tained that an acre of the Briza media cut in flower, weighed 9,528 pounds, which lost, in drying, 6,431 pounds. The amount of nutritive matter was only 409 pounds. Cut when the seeds were ripe, the produce weighed 9,528 pounds and furnished 483 pounds of nutritive matter. The aftermath weighed 8,167 pounds, with only 255 pounds of nutritive matter. A thin, sandy soil gave 10,890 pounds, with 453 pounds of nutritive matter. A moist, clayey soil gave 8,167 pounds and of nutritive matter 293 pounds. A rich, black, loamy soil furnished 9,689 pounds, and 462 pounds of nutritive matter. Sandy soils, as is shown by these experiments, are better suited to it than rich clayey or calcareous soils. It would suit the soils of the Cumberland Table-land, and many parts of West Tennessee. The seeds weigh from ten to twelve pounds per bushel. Analysis shows the dried grass to contain, of flesh-formers, 5.2; heat producers, 42.8; fat, 2.6. It rank among the poorest of the grasses, but is hardy and better than none at all.

SMALL FESCUE.--(*Festuca tenella.*)

The small fescue has a spike-like panicle, somewhat one-sided, from seven to nine flowered; awn awl-shaped, palea slender; leaves bristle-formed; stem slender, six to twelve inches high; leaves slender; flowers harsh, often purplish, panicle nearly erect; has a grayish green color.—*Flint.*

Flourishes on dry thin soils. Not of much value.

SHEEP'S FESCUE.--(*Festuca ovina.*)

Has a narrow panicle, short, tufted, bristle-shaped leaves, of a grayish green color, somewhat tinged with red; spikelets two to six flowered; awn often nearly wanting. Perennial.—*Flint.*

The Fescue grasses are very popular in New England and grow well in Tennessee, having been introduced in some localities. They are perrennial and grow in tufts, and from their profuse foliage they form excellent pasturage for cattle and especially for sheep, hence the name of one variety. Mixed with other grasses the Sheep's Fescue would be a good addition to our native grasses. It would be especially use-

ful on dry hillsides, or sandy, old fields, where blue grass will not thrive well. It has long leaves, and they are much sought for by cattle. It has been grown extensively

in East Tennessee, and is grown in some localities in Davidson county, without much success. The Hon. Staunton Gould says this grass forms the great bulk of the sheep pastures of the Highlands of Scotland, where it is the favorite food of the sheep, and where the shepherds believe it to be more nutritious for flocks than any other. Gmelin says the Tartars choose to encamp during the summer where this grass is most abundant, because they believe it to be the most wholesome for all cattle, but especially for sheep. Linnæus asserts that sheep have no relish for hills and heaths without it. It grows in dry sandy soils where all other vegetation parches up. The roots are long, turf short and dense, making it well suited for lawns. It retains its verdure during the most extended droughts. It will not bear manuring, for then it is dispossessed by other grasses. Its great value is for pasturage upon sandy soils. It will suit the Cumberland Table-land. The Woburn experiments showed that, cut at the time of flowering, the product of one acre was 5,445 pounds, which gave 212 pounds of nutritive matter. The same number of pounds was obtained, cut when the seeds were ripe, but there were only 127 pounds of nutritive matter. The aftermath yielded 3,403 pounds of hay, having 66 pounds of nutritive matter. From this it appears that there is a difference between the results obtained by chemists and practical feeders as to its nutritive properties.

MEADOW FESCUE--RANDALL GRASS--EVERGREEN GRASS.--(*Festuca pratensis.*)

Its panicle is nearly erect, branched close, inclined to one side; spikelets linear; from five to ten cylindrical flowers; leaves linear, of a glassy green, pointed, striated, rough on the edges; stem round, smooth, from two to six feet high; roots creeping. Perennial.—*Flint.*

This grass has received some attention in different parts of the State, and has met with a warm reeeption from those testing it. It ripens its seed long before any other grass, and, consequently, affords a very early nip to cattle. It has been raised under various names, in Virginia, as "Randall Grass," in North Carolina as "Evergreen Grass." In the mountain lands of Virginia, a writer says: "The variety of forage best adapted to sheep-grazing on the mountain lands is the "Randall," a tall, coarse grass, growing freely on the rocky soil to a hight of six feet, remaining green and affording fine herbage all the winter."

Mr. James Taylor, writing to the Agricultural Bureau from North Carolina, says:

"The Evergreen Grass is very good for pasturing through the fall and winter. I have no knowledge of its origin. It will do best when sown on dry land, and is well adapted to sheep. It grows well on rocky soil, to the hight of four or five feet when ripe, continuing green in the spring, and affording fine herbage throughout the winter. It is best to sow in the spring with oats. A peck of well-cleaned seed is enough for an acre, or a bushel in the chaff. It ripens about the first of June, or a little before rye harvest, and is cut with scythe and cradle as we cut rye If sown in the spring this grass will not

go to seed before the next year, but if sown in the fall it will bring seed the next spring. I do not know its yield of hay to the acre, but believe it to be equal to any other grass we have."

From the limited cultivation it has met with in Tennessee, it seems rather to be better adapted to moist, low lands, though I have seen it growing on some of the high ridges of East Tennessee, at least 1,500 feet above the sea. There it thrives luxuriantly, and makes a very superior pasture.

Some of this grass was sown in Davidson county as early as 1850, upon the farm now owned by Col. D. H. McGavock. The place selected for sowing was low, wet and almost marshy. The same spot is yet green with it, still flourishing in unrivaled luxuriance, furnishing more grazing, according to Col. McGavock, than any other grass. The roots penetrate much deeper than the roots of blue grass, descending, indeed, as deep as red clover. In consequence of this it bears droughts remarkably well. Nor do overflows affect it, but rather seem to add to its vigorous vitality.

A small plat of upland was also sown, but it disappeared in about five years, but its disappearance was hastened by the presence of the army worm.

The same rules are to be observed in propagating it as in blue grass.

In Europe this grass is one of the standard meadow grasses, and might be found by further experiment to form a fine addition to the list here. Its name of Evergreen originated from its habit of remaining green under the snow and when it was clear of it, affording fine croppings for cattle. It will grow on a greater elevation than the blue grass.

The seeds weigh about fourteeen pounds to the bushel. An analysis by Messrs. Scheven and Ritthausen found it to contain, when green, water, 74.8; flesh-formers, 2.4; fat,

0.8; heat-formers, 10.2. The Woburn experiments gave at the rate of 13,612 pounds to the acre, cut when flowering, which lost 7,046 in drying, and furnished 957 pounds of nutritive extract. It is a good hay grass.

TALL FESCUE GRASS.--(*Festuca elatior.*)

This is a variety of the same, naturalized from Europe, and suited to a rich loam, such as is found in the Central Basin. The Woburn experiments show it to yield more nutritious matter per acre, when cut in flower, than any other grass, cut either in flower or seed. The number of pounds obtained was 51,046, which weighed, when dry, 17,866 pounds, loss in drying, 33,180 pounds and furnished 3,988 pounds of nutritive extraet.

There are several other fescue grasses, as the Spiked Fescue, (*F. loleacea*), Hard Fescue, (*F. duriuscula*), and the Nodding Fescue, (*F. utans*), all indigenous to this country. The last two are good hay grasses, as well as the Meadow Fescue. The Hard Fescue was analyzed by Way and found to contain water, 69.33; flesh-formers, 3.70; fat, 1.02; heat-producers, 12.46; woody fibre, 11.83; ash, 1.66. The Woburn experiments gave as the produce of one acre, 18,376 pounds, cut in flower; loss in drying, 10,116 pounds; nutritive matter, 1,004 pounds. Cut in seed, the produce weighed 19,075 pounds, loss in drying, 10,481 pounds, leaving nutritive extract, 446 pounds. It grows well on a sandy loam. The seeds weigh ten pounds to the bushel.

COMMON REED GRASS.--(*Phragmites communis.*)

Glumes shorter than the flowers, keeled, sharp-pointed. and very unequal; rachis silky-bearded; palea slender, the lower thrice the length of the upper; stiles long, grain free.--*Flint.*

It grows in swamps and on the borders of ponds. It is found in the Mississippi bottoms from six to twelve feet high, and serves as a fringe to nearly all the swamps of that that river. At a distance it very much resembles sugar

cane. Its large seeds serve as food for the swarms of wild ducks and geese of that region. When young and tender cattle browse on its succulent foliage, but when it gets large it becomes tough and woody. In England it is used in thatching houses and farm buildings. A roof made of this is said to be better than a slate roof, because it keeps the cold out in winter and heat in summer. Such a roof, it is said, will last eighty years if care is taken to keep the moss cleared away. It is universally diffused, both in the Eastern and Western Hemispheres.

CHAPTER XVI.

CANE—COUCH GRASS—VELVET—LAWN GRASS OR MEADOW GRASS—BARLEY—TALL MEADOW OAT GRASS—WOOD HAIR GRASS.

CANE—(*Arundinaria macrosperma.*)

Glumes concave, awnless, small, lower smaller than the upper; scales three, longer than the ovary; stamens three, stems woody. Flowers in March and April, leaves linear, green on both sides, smooth, spikelets from seven to ten flowered, purple, smooth.

When the first settlers came to Tennessee, the whole face of the country was covered with Cane, and while it existed, afforded abundant pasturage to stock of all kinds, both winter and summer. The shoots of young cane are both succulent and nutritious. Not only are they eaten by beasts, but, when young and tender, they are boiled and eaten by man. In 1812 and again in 1864 a famine was averted in India by the opportune seeding of the Cane, the people gathering the seeds and boiling and eating them like rice.

The Cane requires about thirty years to mature and form the seed, then the plant dies, and it again springs up from the roots. It is propagated by suckers from the roots, and it is several years before it is strong enough to serve the purpose of fishing-poles. Its stem has a coating of almost pure silex, and was used by the Aborigines for knives, cups, fans, pipe-stems, fishing-poles, spear-handles, fishing-spears, chairs, tables, bedding, wigwams, etc., etc.. Like all other grasses, it grows from the centre, and though it has graminaceous affinities in all its internal structure, it partakes of the nature of a tree in size, as it often attains a height of of forty, and even of fifty feet.

It belongs to the same family with the bamboo of the

Asiatic and African jungles. There, it is applied to more purposes than any other species of vegetation, and is regularly cultivated. It is there planted in spring or autumn, and is considered ready for cutting at the end of four or five years. Some of the most delicious sweetmeats we have, are made from the young and tender shoots of the Cane by the Chinese. The family of Cane comprises twenty genera and one hundred and seventy species. The switch cane is the seedling, and as the roots becomes older, they thow up from year to year larger stems, provided it is not too much trodden, in which case, it dwarfs and remains switch cane, until it flowers, seeds and dies.

It varies in diameter from ¼ of an inch, to three inches, and in Asia eight inches. The distance between nodes is from four to eight inches, and in some highly prized Chinese varieties, it is from four to five feet. In Asia it is used for an endless variety of purposes, for making houses, boats, masts, furniture, water-pipes, floats for children to learn swimming, life-preservers, and by softening the sections in boiling water and flattening them out, they are used for planks, boards, umbrellas, and in fact, for almost every domestic purpose.

The only uses to which it is applied here, are for pipe-stems, fishing-poles, and for making baskets. It forms most excellent winter pasturage, besides sheltering stock from the inclemency of the weather. Several large farmers in Middle Tennessee still have their pastures of Cane. Almost any portion of Middle Tennessee, if enclosed and unused, will soon send up small Cane, and if unmolested until it attains some size, it will stand very constant grazing. In the bottoms of West Tennessee, in some of the valleys of East Tennessee and on some isolated spots in Middle Tennessee, it yet exists in pristine beauty. But it is fast disappearing, with wild game, before the encroachments of the plow. One of the grandest and most sublime sights to be seen, is the burning of a cane-brake. Sounds as if a terrific

battle raged are heard and a blaze goes up that effectually destroys all vegetation within its fiery circle.

It grows best on the richest land, but if the poorest soil is once set with it, it acts as a fertilizer. This is to be attributed to its wonderful net-work of roots, the immense foliage it deposits on the soil, and to its dense shade. It is a very difficult matter to break up cane land, but once broken, it quickly rots and adds to the fertility of the soil. The roots run to a surprising length and depth, and serve as pumps to raise dormant fertilizing principles from below the reach of any plow.

The farmers living near the Mississippi bottoms find the immense cane-brakes in that region exceedingly beneficial, as they are in the habit of driving their stock to them, and the most luxuriant pasturage is obtained, both summer and winter. It will not grow in standing water, as the presence of water destroys its roots. Therefore, it is only found on parts of ground elevated above the swamps.

Botanists reckon another species called *Arundinacea tecta*, small cane, which is believed by many close observers to be the switch cane spoken of. The A. tecta has a peculiar mode of inflorescence. From the creeping root are thrown up simple leafless culms from six to twelve inches high with a few spikelets in a simple raceme. These spring up in April, and are highly relished by every kind of stock.

COUCH GRASS, Twitch Grass, Chandler Grass, Dog Grass, Witch Grass, Quack Grass, Quake Grass, Squitch and Wheat Grass—(*Triticum repens.*)

Has creeping roots; stem erect, round, smooth, about two feet high striated, having five or six flat leaves, with smooth, striated sheaths; the joints are smooth, the two uppermost very remote, leaves dark green, acute, upper one broader than the lower ones, roughish, sometimes hairy on the inner surface; smooth on the lower half. Inflorescence in spikes. Flowers in June and July.—*Flint.*

This grass, though more a troublesome weed than an agricultural acquisition, was brought from Europe by some one,

under the supposition it was a good grazing grass. It creeps with its vigorous roots rapidly, and though having an abundance of foliage, it is too coarse and rough for fodder. Each joint will produce a new plant, which, in turn, sends out in every direction new scraggy roots, that reproduce other plants. When young and tender it is eaten by stock, and it

is a favorite grass with dogs, who eat it to excite vomiting. It is apt to take possession of wheat lands, and is exceedingly troublesome to get clear of, a single root in the ground serving as a nucleus for a plantatation of them. The only way to get rid of this troublesome pest, is to gather, dig and burn; or, if while the land is dry and the weather hot, it is plowed frequently, it may be killed. But to interfere with it during wet weather, by either digging or plowing, is only to assist in its propagation. Its principal growth takes place in autumn, when its roots spread horizontally and obliquely in every direction, and continue to grow rapidly until arrested by cold weather.

The roots are succulent, and are industriously hunted for by hogs, who eat them with avidity. In some of the poverty-stricken countries of Northern Europe, the roots are dug, dried and ground into meal, which is made into bread by the poorer classes, who are thus enabled to sell their wheat to the rich They are also fed, in some locality, to cattle and horses. It belongs to

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the family of wheat, and it has been argued by some, that it hybridrizes with wheat, and by others, that it is the parent of wheat. From the large amount of salts in its composition, land that has been infested with it, produces wonderfully large turnips. It is said, however, to impoverish land, as to other crops. It exists principally in the Northern States, but has acquired a foot-hold in some sections, being brought in with seed wheat, the seeds resembling wheat exactly, except they are smaller. The heads are also very much like the wheat heads.

VELVET LAWN GRASS--MEADOW SOFT GRASS—(*Holcus lanatus.*)

Spikelets two flowered, jointed with the pedicels; glumes boat shaped, membranaceous, enclosing, and exceeding the flowers; lower flower perfect; its lower palea awnless and pointless; upper flower staminate only, bearing a stout bent awn below the apex. Stamens three, grain free, slightly grooved. It grows from one to two feet high; stem erect, round; root fibrous, perennial; leaves four or five, with soft, downy sheaths; upper sheath much longer than its leaf, inflated, ligule obtuse; joints usually four, generally covered with soft, downy hairs, the points of which are turned downwards; leaves pale greeen, flat, broad, acute, soft on both sides, covered with delicate hairs. Inflorescence compound, panicled, of a greenish, reddish or pinkish tinge; hairy glumes, oblong, tipped with a minute bristle. Florets of two palets. Flowers in June.

This is one of the most beautiful grasses we have, and grows wild on swampy moist lands. It abounds on the marshy flats of the Cumberland Mountains, but it is not of such tempting relish that stock will not eat it ravenously. It grows well in West Tennessee.

As a grass for lawns, however, or yards, unless it is desired to use them as pastures, it is unequalled, and is easily propagated. It needs but to be sown slightly, and afterwards will quickly sow itself. A yard turfed over with this grass presents a most lovely appearance, and looks as if spread with a velvet carpet.

But, Mr. Gregory, of North Carolina, says: "It was on my place 35 or 40 years ago when first bought, and is

found in several other places in this county (Oxford). It would seem from this it is indigenous to our clay lands. I gathered the seed on my land, and have now some two acres sown, and have just cut (June 29th,) the prettiest lot of hay I ever saw. Orchard grass in the same field will not compare with it."

Several analysis of this grass have been made, which are given below:

Water.	Flesh Formers	Fat.	Heat Producers.	Woody Fibre.	Ash.	Analyzed by
69.70	3.49	1.02	11.92	11.94	1.93	Way.
75.1	2.8	0.5	9.5	10.2	2.4	Scheven & Ritthausen.

The hay, as analyzed by Wolff and Knop, shows water, 14.3; flesh formers, 9.9; fat, 3.1; heat producers, 36.7; fibre, 33.6; and, ash, 5.5.

From the experiments of Sinclair, at the Woburn farm, we learn that the produce from an acre cut in flower, was 19,057 pounds; loss in drying, 12,395 pounds, retaining nutritive elements, 1,191 pounds. The grass weighed the same cut when in seed, and lost 15,246 pounds in drying, and yielded 818 pounds of nutritive matter. The aftermath yielded 6,806 pounds of grass and 373 pounds of nutritive matter.

The chief merits of this grass are its soft beauty, its productiveness, and its tenacity of life. When once well set, it bids defiance to all other species. Enriching the soil is the only way to get rid of it. It grows well upon thin sandy places, and will therefore suit the sandstone soil of the Cumberland Mountains. The seeds weigh about seven pounds to the bushel, and as many as eighty bushels have been grown to the acre.

BARLEY GRASS--(*Hordeum pussillum.*)

Spikelets one flowered, with an awl-shaped rudiment on the inner side, three at each joint of the rachis, the lateral ones usually abortive or imperfect, short stalked; glumes side by side in front of the spikelets, slender and bristle-form; lower pale convex, long awned; stamens, three; grain long, adhering to the pales.—*Flint.*

Barley Grass is found usually in brackish marshes, and grows from 6 to 12 inches high. It looks very much like barley, and is much relished by cattle, and when full of seeds, it is very nourishing. It could be sown on places that would scarcely produce anything else, as in swampy localities. It is not of much value in an agricultural point of view, though stock will eat it.

TALL MEADOW OAT GRASS--(*Arrhenatherum avenaceum.*)

Spikelets two flowered, and the rudiments of a third, open; lowest flower staminate or sterile, with a long bent awn below the middle of the back; leaves flat, acute roughish on both sides, most on the inner; panicle leaning slightly to one side; glumes very unequal; stems from two to three feet high; root perennial, fibrous, sometimes bulbous. It has two florets, the lower one having a long awn rising from a little above the base of the outer palea, and this peculiarity distinguishes it from all other grasses It Flowers from May to July.—*Flint.*

This grass is very popular in France, from whence it was introduced, and is there known by the name of "Ray Grass."

It will grow well on any land that produces clover. Its limit is about 1,500 feet above the sea. It grows quickly and forms a very excellent grass for early pasturage, probably earlier than any other. It is mown down for hay,

and, after cutting, it throws up a perfect mat of aftermath, that will yield an extremely rich pasture. It was only introduced into Tennessee a few years ago, and it has received extravagant praises, as is usual with new introductions.

It succeeds well in West Tennessee, and will probably suit that locality better than any other grass, except Herds grass. It would form a good grass to mix with others, such as timothy, Herds grass, clover or blue grass.

The analysis of the hay by Way, is as follows: Flesh formers, 12.95; fatty matters, 3.19; heat-producing principles, 38.03; woody fibre, 34.24; mineral matters, 11.59.

Other analyses may be found on pages 30 and 36.

This shows it to rank as a nutritious grass, among the best of the meadow grasses, and almost equal to any of the pasture grasses, though it is said cattle and sheep do not like to be confined to it alone. The produce from an acre from Mr. Sinclair's experiments at Woburn, was 17,015 pounds; loss in drying, 11,635 pounds; nutritive matter, 664 pounds. Cut when the seeds were ripe the weight was 16,335 pounds; loss in drying, 10,617 pounds; nutritive matter 255 pounds. Weight of aftermath, 13,612 pounds; nutritive matter of which was 265 pounds.

WOOD HAIR GRASS--(*Aira flexuosa.*)

Stems slender, one or two feet high, nearly naked; leaves dark green, often curved, bristle-formed; branches of the panicle hairy,

spreading, mostly in pairs; lower palea slightly toothed; awn starting near the base bent in the middle, longer than the glumes, which are purplish. Perennial. Flowers in June.—*Flint.*

This grass grows on all the rocky hills, and extends to the tops of ordinary mountains, flourishing in sandy soils. It is readily eaten by cattle and sheep. It is often transplanted to gardens for ornament, its delicate stem and spreading panicle, making a charming addition to bouquets. On soils suited to it, it yields more forage than sheep fescue. The Woburn experiments show at the time of flowering the product of the grass was 10,209 pounds per acre, which lost 6,891 pounds in drying, and yielded 319 pounds of nutritive matter. Cut when the seeds were ripe, the grass weighed 9,528 pounds; loss in drying, 5,955 pounds; nutritive matter, 297 pounds. It will not thrive on a clayey soil.

CHAPTER XVII.

COMMON CRAB GRASS—PROLIFIC PANIC GRASS—SWEET-SCENTED VERNAL GRASS — PAMPAS GRASS — RAMIE—RIBBON GRASS — CANARY GRASS — FIORIN — WHITE CLOVER—JAPAN CLOVER — HERDS GRASS — ORCHARD GRASS.

COMMON CRAB GRASS.--(*Panicum Sanguinale.*)

The history and uses of this native grass have been fully given with the Meadow grasses, on page 101, to which the reader is referred.

PROLIFIC PANIC GRASS.--(*Panicum proliferum.*)

Another species of above, differing only in having the culms thickened, succulent. branched and bent, ascending from a procumbent base, and spikelets appressed, lance—oval, of a pale green color.—*Flint.*

It inhabits, as a general thing, river bottoms, though sometimes appearing on dry hills. In its value as a grazing grass it is almost identical with the preceding. Cattle are fond of it, and it grows spontaneously.

SWEET-SCENTED VERNAL GRASS.--(*Anthoxanthum odoratum.*)

Spikelets spreading, three flowered; lateral flowers neutral, with one palea, hairy on the outside, and awned on the back; glumes thin acute, keeled, the upper twice as long as the lower; seed ovate, adhering to the palea enclosing it; root perennial. Flowers in May and June. Stems from one and a half to two feet high —*Flint.*

This grass was introduced from Europe, and possesses rather poor qualities as a pasture grass, as neither sheep nor cattle relish it. It is early, however, and hardy. It is one of the first as well as one of the last grasses that appear. Its nutritive qualities are said to exist to a much larger extent in the fall than in the spring, and greater when cut

at maturity than in bloom. It has a mixture of benzoic acid among its constituents, which imparts to it a highly aromatic character, and this is so strong that other grasses with which it may be mixed are affected by it. It is not in

general use in Tennessee, but would probably add to the value of pastures if sown with other grasses. Cows running on it are, by some, said to give a rich milk and highly flavored butter, but Mr. Gould thinks this is an error. It may be known by rubbing its green leaves in the fingers, to which it yields its scent. On certain soils favorable to its growth, it will root out almost every other kind and take complete possession. Its seeds have a spiral awn, and when taken in the hand, affected by its moisture, the awns will uncoil, and the seeds will appear to move as insects. There are six or seven pounds in a bushel, and nine hundred and twenty-three thousand two hundred in a pound. Its analysis, according to Way, ranks it, when dry, a little higher than blue grass, as follows; Flesh-formers, 10.43; fatty matters, 3.41, and heat-producing principles, 43.48. Blue grass gives, flesh-formers, 10.35; fat, 2.63; heat producers, 43.06.

The same chemist gives the following as its composition when green: Water, 80.35; flesh-formers, 2.05; fat, 0.67; heat-producers, 8.54; woody fibre, 7.15; ash, 1.24. Scheven and Ritthausen's analysis, grass green, gives the following result: Water, 72; flesh-formers, 2.1; fat, 0.8, heat-producers, 11.2; woody fibre, 12.3; ash, 1.6. Still another analysis may be found on page 36.

Sinclair showed that when grown upon a sandy loam well manured, the produce of an acre, cut in flowering time,

was 7,827 pounds, which lost 5,723 pounds in drying, and yielded only 122 pounds of nutritive matter. But when the seeds were ripe the produce per acre was 6,125 pounds, which lost, in drying, 4,287 pounds, and yielded 311 pounds of nutritive matter. The produce of the aftermath was 6,806 pounds per acre, which yielded, of nutritive matter, 239 pounds. The experiments of Sinclair and the analysis given by Way show very different results. The reader should constantly bear in mind that these analyses and experiments are not conclusive, and they should be repeated many times to command implicit confidence. The best test of all grasses is their effects upon animals. If animals thrive and fatten upon any grass, and that grass is perennial, hardy and durable, it is a good pasture grass; otherwise not, whatever individual experiments in the laboratory may indicate. We know that stock of all kinds eat blue grass voraciously and thrive upon it; we know, also, that they do not like the *anthoxanthum.* Both are alike hardy and durable Therefore the blue grass, upon suitable soils, is to be preferred, whatever chemical research may determine.

PAMPAS GRASS.--(*Gynerium argenteum.*)

Tall, reed-like grass, with large tuft of rigid linear and tapering, recurved, spreading leaves, several feet in length; the flowering stem 6 to 12 feet high, flowers in autumn, silky, downy, silvery panicle.—*Gray.*

This is the grass of the historic plains or pampas of South America, and is only cultivated for ornament here. Its beautiful, feathery panicles make a fine ornament for vases. It must be protected to survive our winters, by brush or straw thrown over its roots. It is not included in the list of grasses given on page 70, and is really to us only a curiosity, and not of any value in a commercial point of view.

RAMIE GRASS, CLOTH PLANT.--(*Bœhmeria nivea.*)

Flowers diœcious, or intermixed, clustered in spikes; tough, fibrous bark, the fertile flowers with a tubular or urn-shaped calyx, barely toothed at the apex, inclosing the ovary, and closely investing the oblong flat akene; leaves ovate, white, downy beneath; three to four feet high.

This, though called the China cloth plant, really is not a grass or allied to the grasses, but belongs to the Nettle genus and is akin to the Hemp.

It has been lately introduced and cultivated for its fibre, of which goods, cloth, and paper are made.

It has only been known within a few years to possess nutritive qualities, but from the appended letter from Col. Sam'l. D. Morgan, of Nashville, it will be seen it has no mean virtues as a forage plant. The yield per acre is said to be enormous, as much as 1,200 pounds of the dried bark having been taken from one acre. It has never, to the knowledge of the writer, been raised in Tennessee, nor is it certain that it would grow in this climate, it being a native of India, but it can be easily tested, and if its virtues here are equal to the test given by Col. Morgan, it would be a most excellent green soiling crop, and would take a stand by the side of corn fodder or clover. It is not included in the list of Tennessee grasses given elsewhere.

NASHVILLE, Nov. 23, 1877.

J. B. Killebrew, Commissioner of Agriculture, etc.

DEAR SIR:—I have a letter from Commissioner W. G. LeDuc, asking to be informed by me of the result of experiments made in the cultivation of "Ramie, or China grass plant."

Some ten or more years since I obtained a package of the seed, but having no convenience for growing the plant, I sent them to my son-in-law, Dr. J. A. Duncan, of Barnwell Court House, South Carolina, who planted them in his garden, where they grew and flourished vigorously. Some two or three years later his wife prepared a small quantity of the fibre and sent it to me to be exhibited at our State Fair, which I did, and where it was greatly admired for its perfect lustre and exceeding great strength, and though there was no premium for such fibre offered by the society, she was awarded a handsome one for her exhibit. In a

word, I consider it a plant well adapted to the climate of South Carolina, if not further North.

But whether it be desirable to cultivate it for its fibre or not, it proved in Dr. Duncan's hands an admirable forage plant, "none like it," as he says. He informed me that "his cow and horses devoured it with great gusto," passing through good pastures to get to his garden, even breaking down his fences to get at it. He further informs me that it is quite succulent, and wonderfully nutritious, not only fatten ing, but giving to the hair of the animals using it a very smooth and satin-like appearance.

This is certainly a plant worthy of exertions being made to introduce into the South.

Respectfully. S. D. Morgan.

It is a plant very susceptible of cultivation by both seeds and suckers. Its growth is rapid, vieing with tropical weeds in luxuriance. It thrives best in a moist climate, but is not very particular as to soils. In Jamaica it grew six and a half feet in fourteen days, according to the authority of Mr. Simmonds, of the "Technologist." It was brought into Calcutta from Bencoolen in 1803, and there cultivated in the Botanic Gardens for some years until he disseminated it. The seeds are sown on a light sandy soil, it being thoroughly pulverised first, and not covered at all except by the soil with which they are mixed before sowing. The beds must be watered until germination takes place. When the plants are four inches high, they must be transplanted into rows three feet wide and six inches apart. The soil may be any rich, stiff kind of land. This plan is for getting a start when the seeds are scarce. The roots will soon throw up numerous suckers that may be drawn and set like sweet potato slips. However, after the seeds are secured by the farmer, he can sow in rows very lightly, and chop across with a hoe to give the plants room to spread.

The proper time to sow is as early as the land can be prepared. It will be ready to cut in June, and, if desired, can be again and again cut until frost begins. In the last cutting the soil should be thrown over the stubble to pro-

tect the roots during winter, and no more planting will be necessary for several years, as the roots are perennial. They are fleshy tubers and will be quickly eaten up by hogs if they are allowed to get to them. The plant is a very promising one for green soiling, and a citizen of a village or town having a small lot may be able to supply a horse or cow with green forage through the whole summer. It has never before been recommended as a forage plant, and should any one interested in this account wish to test it, seed doubtless can be procured from the Agricultural Bureau at Washington, D. C.

RIBBON GRASS.--(*Phalaris arundinacea.*)

Panicle very slightly clustered, somewhat spreading when old; glumes wingless, rudimentary florets, hairy; stem round, smooth, erect, from two to seven feet high; leaves five or six in number, broad, lightish green, acute, harsh, flat-ribbed, central rib most prominent on highlands, with white stripe down centre, solid green on wet lands, roughish on both surfaces, edges minutely toothed; smooth, striated sheaths.

This grass is exceedingly hardy and showy, but is of but little value as a hay or pasture grass. It is raised in almost every garden, on account of its beautiful foliage. It is called also Fortune grass. Hon. John Stanton Gould says of this grass:

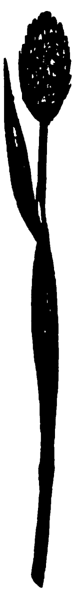
"Its roots interlace very closely, and after a few years swamps are so compleły covered with them as to bear a wagon and horses without breaking through. It is also very useful in protecting river banks, but in narrow brooks it is apt to fill up the channel and thus

convert a large area into swamps. Its flowers vary greatly in their hue according to position. Their general color is whitish or pale green, but they are met with when they exhibit rich shades of purple and yellow, and with red instead of yellow anthers. The rudimentary flowers on either side of the fertile paleæ are not invariably to be met with. We have seen flowers that have had only one of these, and sometimes neither is present. Its seeds weigh from forty-eight to fifty pounds to the bushel, and the birds are very fond of them. Half a bushel to the acre is quite enough to sow under any circumstances, but it is most commonly propagated from cuttings of the root, one piece being deposited to every square foot, in the early spring, in ground that has been well prepared and pulverized by frost. Linnæus says that it is extensively used for fodder in Sweden and is liked by the cattle. In the province of Scania it is mown twice a year. The peasantry there use it as a thatch for their cottages and hay stacks, and find it more durable than straw, It is very certain that cattle in our own country do not relish it, either as pasture or hay, and they will not touch it so long as they can get anything better. It might, however, be utilized even here by the proprietors of marsh lands. When cut very young, say when about one foot high, and used for soiling, cattle eat it better than in any other way. When it becomes older it is very rigid and becomes distasteful, and should never be used as fodder. The creeping roots are probably nutritious; they have a sweetish flavor, and pigs will devour them with avidity. Its composition, as stated by Messrs. Scheven and Ritthausen, is: Water, 68.9; protein, 1.9; fat, 0.4; heat-producing principles, 12.6: woody fibre, 13.5; ashes, 2.6. According to the Woburn experiments, a black sandy loam incumbent on clay at the time of flowering yielded from an acre 27,225 pounds of grass, which lost 14,973 pounds in drying, and afforded 1,701 pounds of nutritive matter. From a strong, tenacious clay the produce was 34,031

pounds of grass, which lost 17,015 in drying, and afforded 2,126 pounds of nutritive matter. If these experiments are trustworthy, it seems that a clay soil produces 4,764 pounds more of dry hay to the acre than a black sandy loam, and that 100 pounds of grass from it affords 6.3 pounds more of nutritive matter. If it is chemically true that this grass yields so much more nutriment than timothy, redtop, fescue and other favorite grasses, it is equally true that the stomachs of cattle are not so organized that they can extract it, and that it will not lay on anything like as much flesh nor give as liberal a flow of milk."

CANARY GRASS.--(*Phalaris canariensis.*)

Spikelets from five-sixteenths to six-sixteenths of an inch long, oval, compressed closely, imbricated and beautifully variegated with green and white, as shown in the illustration, where the dark part represents the green shades. Glumes flattened, ovate, unequally distributed about the central rib, about twice as long as the palea, clothed with short appressed hairs, nerves with greenish margins. Rudimentary flowers half the length of the perfect one, smooth below, slightly hairy at the apex. Paleæ of the perfect flower ovate lanceolate, hairy; the lower one obscurely five nerved. Panicle spike-like, with very short branches about one-seventh of the length of the spikelets, oval, compact. Culm eight to eighteen inches high, bearing three or four leaves. Sheaths inflated, somewhat roughish. Ligule acute, the upper one pointed. Leaves from one-fourth to three-eighths wide, one to three inches long, pale green, glaucous. Seed ovate, invested with the hardened palea. Flowers in July.—*Gould.*



Canary grass is a native of the Canary Islands, and may often be seen in waste places. It has flowers very similar to the preceding, and belongs to the same species. Cattle devour it when young, but being an annual, and not a very luxuriant grower, it is not of much value as a forage crop. It yields from thirty to forty bushels of seeds per acre, which are extensively used in feeding canary birds.

FIORIN, BENT GRASS.—(*Agrostis alba.*)

Stem hollow or soon becoming so, spikelets in panicles, sometimes crowded, but never so as to form a spike, flowers one and perfect in each spikelet, with or without rudiments of others, stamens three, rarely fewer, stems with procumbent or creeping base, ligule long and conspicuous, panicle more dense, greenish or slightly purplish. Perennial.

Fiorin is quite popular in England as a meadow grass, and is known as 'Bent grass' or White Bent. It belongs to the same family as the herds grass, and is very like it. It is nourishing, and makes a good grass for pastures. In Tennessee it cannot hold rank with many others as a meadow grass, but it is of sufficient value to deserve mention.

WHITE CLOVER.—(*Trifolium repens.*)

Its stems are spreading, slender, creeping; leaves inversely heart-shaped; flower heads small, white; pods four-seeded, roots perennial; flowers from May to September.

White Clover has been lauded to the skies by some, and by others depreciated as a vile weed. It is beyond question next to blue grass, one of our most valuable grazing plants. Its analysis shows it to be equal to red clover in most respects, and superior as a fat producing plant

It is to the pasture what red clover is to the meadow, and is a suitable food not only for cattle and horses, but for hogs. They thrive amazingly on it. After the first

flowering it salivates horses, but it has no such effect on cattle or sheep. As a honey-producing flower, the White Clover is not surpassed by any plant, the florets, some years, being almost full of syrup.

It varies very much in different years, sometimes almost disappearing, then again, another year, being thick in every pasture. So much is this the case, that we have what are called "White Clover years." This is due to the presence or absence of rain. When there is a wet spring White Clover appears in great luxuriance everywhere, and in dry weather it only shows itself in abundance on moist lands.

It is indigenous to both Europe and the United States, and, though growing everywhere here, it has to be sown on the Northern pastures. Here it comes spontaneously, almost taking every other grass, and sometimes destroying other grasses. It is an invaluable accompaniment of blue grass, especially triumphant where the blue grass is pastured too heavily.

The comparative value of White and red clover, cut in bloom, may be seen by the following analyses by Prof. Way:

	Water.	Flesh formers.	Fat.	Heaters.	Woody fibre.	Ash.
Red Clover	81.01	4.27	.69	8.45	3.76	1.82
White Clover...	79.71	3.80	.89	8.14	6.38	2.08

Other analyses may be found on pages 34, and 37.

JAPAN CLOVER OR KING GRASS--(*Lespedeza striata.*)

Leaves pinnately three folio late; stipules small and free or falling early. Flowers purple rose color or white; stamens diadelphous; anthers uniform; pod flat and thin, ovate or arbicular, reticulated.

It has been but a few years since this plant has been brought to notice in this country, though its existence was mentioned as early as 1784 by Thunberg, a German chemist, who saw it growing in Japan. About the year 1849 it was noticed in the vicinity of Charleston, S. C., the seeds having been brought probably from Japan or China in tea boxes. A short while afterwards it was discovered at a distance of forty miles from Charleston, and still later near Macon, Ga.

Within the last six years it has developed itself in many of the counties of this State, especially in Henderson and Warren, where it is covering all old fields, and in many instances rooting out broom grass and other grasses, showing itself well worthy of the name given it by Mr. Pendleton, of King Grass.

It seems especially adapted to the Southern States, not flourishing above 36°, growing with great luxuriance on the poorest soils and retaining vitality in its roots in the severest droughts. It is said to be a fine plant for grazing, and being perennial in warm climates, needs no re-sowing and but little attention. On soils unfit for anything else it furnishes good pasture and supplies a heavy green crop for turning under and improving the land. It cannot stand severe cold, and in high latitudes cannot be depended on as a good pasture grass, although it comes up and supplies an abundant forage for a few months. It should be sown in January or February in the Southern States, and about one bushel of seed to ten acres is required to secure a good stand the first year. It is said to be an excellent renovater of old fields, and to bring them up to a high degree of fertility in an incredibly short space of time.

Mr. E. M. Pendleton, of Georgia, speaking of it, says: "I am willing to concede to it several things that do not

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apply to any other plant we have ever grown in this latitude.

1. It grows on poor land with more luxuriance than any other grass or weed I have ever seen; and as it has a small leaf, rather contravenes the general idea of vegetable physiologists, that large leaved plants feed mostly on the atmosphere. I suppose, however, that this deficiency is counteracted to a large extent by the number of leaves, for they are legion.

2. It has great powers of endurance, so far as the roots are concerned; but the branches and leaves will parch and die out under a burning sun very soon, especially where it grows sparsely. During a wet summer it luxuriates whereever propagated on poor hill-sides as well as meadow lands. It loves, however, rainy seasons on thirsty lands, and I fear will not prove to be all we desire in such localities. It, however, reminds us of an anecdote of Mr. Dickson, when he was showing some gentlemen his farm during the prevalence of a severe drought. As they passed through a cornfield in which some of the stalks were actually dying for lack of moisture, one of them called his attention to several in that condition. "Yes," said he, "I perceive the fact—but *it dies game.*" And so of the Japan Clover, it dies from severe drought, but rallies again as soon as the rain sets in.

3. It is good pasturage for stock, and I think would make good hay, if cut and cured. This I intend to test the present season. But I do not believe that our stock like it as well as the native grasses, and I doubt whether it is as nutritious as the Bermuda. As cattle love variety, however, this may subserve a good purpose in that way. My opinion, however, is, from not a very close observation in the matter, that they would soon tire out on it exclusively.

4. It furnishes a large supply of vegetable matter to the soil, and I believe will prove to be the best humus making plant we have at the South, where so much is needed from

our clean cotton culture. As it is said to be difficult to gather the seed in large quantities, I intend to plow up the surface where it has seeded, and rake up the grass and top soil, and sow this dirt over my oat and wheat fields, and especially on the poor places. My opinion is that a most luxuriant growth of this clover will follow, which can be turned under in the fall while green, and thus furnish not only humus but nitrogen to the soil.

5. Another rare quality of this plant is indicated in the name I have given it—King Grass—in the fact that it absolutely roots out and destroys every living plant in its wide-spread path. Not even old Bermuda, which has so long held undisputed sway over his circumscribed fields, can resist its encroaches. I have a bottom long since given up to the Bermuda. Recently I passed through it and found that the Lespedeza had almost completely throttled it, though like Mr. Dickson's corn, *it died game*, as here and there, peering above its enemy, could be seen an isolated sprig of Bermuda, which, as it cannot stand shade, will have to yield entirely before the close of another season. I have but little doubt that any pest like Coco or Bermuda could be rooted out by this *King Grass* in a few years in any locality, and would recommend it to be sown on such fields if for no other purpose. I intend to give it a fair trial myself on one or two similar localities."

In like manner the Hon. H. W. Ravenel, of South Carolina, regards it with great favor, and thinks its timely appearance will be ultimately a source of great wealth to the people of the Southern States. Many places that were regarded as worthless before its appearance, are now made profitable as a pasture, with the aid of this grass.

Mr. Samuel McRamsey, of Warren county, says this clover made its appearance in that locality in 1870. It is fast covering the whole country. It supplies much grazing from the first of August until frost. It is short, but very hardy. Sheep are very fond of it, and cattle will eat it. It

is killing out the broomsedge wherever it appears. It grows exceedingly well on red clay, and with a little care covers red hillsides that are much too common all over the State. If it will do this and destroy the broom grass, it should be cultivated. It is not good for meadow and is only valuable for pasture.

The Hon. M. T. Polk considers it almost worthless for grazing, having made many experiments with it. His opinion is entitled to great weight.

HERDS GRASS AND ORCHARD GRASS.

These grasses have been treated at length under the head of Meadow Grasses. Both are favorite pasture grasses, indeed, preferred for the pasture to the meadow. In my experience and observation I knew of no grass which will give more general satisfaction upon every soil as a pasture grass, than Herds Grass. It is nutritious, hardy, tenacious of life, a luxuriant grower upon wet or dry soils, and is highly relished by stock. In low places where water is likely to stand after heavy rains, it will flourish and retain its vitality. Many swampy places can be made profitable by being sown in this grass, as its interlacing roots consolidate the ground, making a tight surface over which cattle can feed without miring. It has never been valued at its actual worth.

Orchard Grass is not so hardy as Herds Grass, though probably it is more nutritious, or at least, more palatable to stock. I have observed on two pastures, side by side, the one sown with Orchard Grass and the other with Herds Grass, that stock will prefer the Orchard Grass to the Herds Grass. This may be owing to the fact, that Orchard Grass has a more rapid growth, and is therefore tenderer and more succulent. Both are good, but the Herds Grass will stand more tramping and grazing than the Orchard Grass, and will thicken into a sward while the Orchard Grass will become thinner year after year. The first season after sowing,

Orchard Grass will make the better pasture, but every succeeding year will show the Herds Grass to advantage.

This closes the list of valuable pasture grasses for this State. Others now regarded as of no importance, may prove valuable by culture. One fact is certain, we have more useful grasses than we cultivate. Any three or four of the best varieties sown and properly cared for will prove a boon to the farmers of the State.

NATIVE FORAGE PLANTS IN TENNESSEE

PART IV.

CONTRIBUTED BY DR. A. GATTINGER, NASHVILLE, TENNESSEE.

The object of this contribution is to impart some specific knowledge about those plants which constitute the natural food supply of the grazing animals. I had never expected that my casual and accidental observations in this particular direction would ever come into publicity, and, besides the request for this met me unprepared. Yet I have considered it my duty to accept Mr. Killebrew's friendly and polite request, as an opportunity to conduce some to the public welfare and to general information.

During a thirty years' residence in this State, for many of them with the ample opportunities of a country physician, I have devoted the time unoccupied by professional duties, to the study and collection of the flora of this State, which I have traversed on botanical explorations from the summit of the Blue Ridge to the sandy banks of the mighty Mississippi.

The grasses and leguminous plants enumerated I know, from their aspect in nature, their mode of growth, time of inflorescence, the

soil to which they are addicted, and their uses where such are known. They are, furthermore, in my private collection, and I intend to continue my labors. The description of the plants are given according to the excellent works of Prof. A. Gray, A. W. Chapman's Flora of the Southern United States. Torrey's Botany of the State of New York. The wood-cuts illustrative of a few genera of grasses are from Gray's Manual Some information I have also derived from the Agricultural Reports

Two families of plants, the Gramineæ (grasses and cereals) and Leguminosæ (wild vines, peas, etc.), contribute in such a degree to the support of the herbivores, that all the rest is, for this purpose, almost insignificant. What plants are suitable or not can only be learned from observing stock in pastures, what they eat or reject, when they are in a well-fed condition.

From a list of grasses given in a former chapter I have selected the most frequent and valuable for the subjoined special descriptions.

In that portion of the United States lying east of the Mississippi and extending to the Atlantic, there are at present known to exist 287 species of the gramineæ indigenous to the soil. In the territory west of the Mississippi, and extending to the Rocky Mountains, there are 143 species, of which only 52 species belong to this region exclusively, ninety-one of them belonging also to the eastern region. So it appears that we have 339 species over this wide domain. About one-half of these are found within the limit of the State of Tennessee. Many of them are valuable for forage, but many are worthless or noxious to the agriculturalist.

CHAPTER XVIII.

ANDROPOGON—TRIPSACUM — SETARIA — PANICUM — PASPALUM — GYMNOSTICHUM — ELYMUS — AIRA — DANTHONIA—TRITICUM.

ANDROPOGON, L.-- (*Andropogon.*)

ANDROPOGON SCOPARIUS, L.

Commonly called broomsedge, a great eye-sore if it takes possession of meadows, but a good pasture grass before it shoots up its culms, after which time stock will touch it no more. It disfigures, with its straw-bundle-like tussocks, the pleasant verdure of a spring landscape, and the half decayed stalks, if mixed with new hay, incline to make it mouldy. Another such compatriot is

ANDROPOGON FURCATUS, Muhl.--(Also called *Broom Grass*)

Taller and stouter than the former, the culm terminated with 2-4 digitate flower spikes, in the manner of crab grass. It is not so much at home in open meadows and old fields but prefers open woods, fence corners and out-of-the-way nooks. A third associate is the

ANDROPOGON VIRGINICUS, L.--

Closely resembles the first, but the flower spikes are nearly wholly wrapt up in leaf-like grass blades or sheaths, and the spikelets are very much silky bearded. It is found in all sorts of localities, dry and wet, but rather dispersed over widely distant localities, and consequently not so common as the first two.

ANDROPOGON MACROURUS, Michx.--(*Cluster-flowered Beard Grass.*)

This has stems two or three feet high, branched, with many spikes, bushy, forming thick clusters; rough, hairy sheaths.

It differs from the preceding species of same genus in growing in swampy lands Like the others, it is worthless.

ANDROPOGON ARGENTEUS, L.--(*Silver Broom Grass*).

Spikelets in pairs, on peduncles exceeding the sheaths, dense and silky. Flowers in September.

Not frequent. East Tennessee along the mountains. It is useless to the agriculturist.

Another interesting species of the division of the Andropogoneae is the *Sorghum nutans, Gray,* a tall and elegant grass, 3-6 feet high, with a narrowly oblong panicle at length drooping, of russet brown and shining color. It grows either single or but few culms from one root and passes under the name of Wood Grass or Indian Grass, and is one of the most conspicuous objects in open barrens and waste places during the late fall season. The farmers in the Western countries, in default of meadows cut this, and A. Scoparius and Furcatus before heavy frost, and store it as hay.

Two other species related to the above are found in the State, viz: Erianthus alopecuroides and Erianthus strictus, both growing on siliceous soil, (Tullahoma, White-bluff, etc. etc). The first deserves to be cultivated as a garden ornament for its large and plume-like spike which is exceedingly graceful.

TRIPSACUM DACTYLOIDES, L.--(*The Gama Grass*). *Perennial*

This species is frequently overlooked for it resembles greatly a depauperate form of Indian corn from the outline of the flowerspike and the broad leaves, which look exactly like those of corn. But the tassel which is only male in corn, bears here both female and male flowers, and the lateral spike of the corn is absent. Where it is abundant and better supplies not on hand, it is cut and dried for fodder.

SETARIA VERTICILLATA, Beauv.--(*Bristly Foxtail.*)

Spikelets awnless, with short peduncles, cylindrical spikes two or three inches long, pale green, somewhat interrupted with whorted, short clusters, bristles single or in pairs, roughened, or barbed downwards, short.

This is one of the foxtail grasses, some of which are very good grazing when young. They are found on all old fields, about yards—in fact wherever man is there are the foxtails. They are all annuals and take good care to sow themselves.

SETARIA GLAUCA, Beauv--(*Blue Foxtail*).

Stem from one to two feet high, leaves broad and hairy at the base, sheaths smooth ligule bearded, spike two or three inches long dense, cylindrical, bristles six to eleven in a cluster, rough upwards; perfect flower transversely wrinkled.

Flowers in July and inhabits the territory appropriated everywhere by the foxtail family, that is cultivated lands.

SETARIA VIRIDIS, Beauv.--(*Green Foxtail*).

Has a cylindrical compouned green spike, bristles longer than the spikelets, few in cluster, perfect flower stirate lengthwise and dotted. Annual, and flowers in June.

PANICUM, L.

Is a genus rich in indigenous species. The Subdivision Setaria is well known through the German and Italian Millet, Panicum Italicum, etc. P. sanguinale is a common grass, abounding in cornfields at the end of summer, furnishes the principal picking to stock after corn-gathering, but its value at that time is but small, the saccharine matter being then converted into cellulose, and the seeds dropping out as they ripen, the spike is mostly empty.

PANICUM GLABRUM, Gaudin.

Abounds in orchards and pastures, and resembles the former very much, but the whole plant is glabrous, while the former is mostly very hairy.

PANICUM PAUCIFLORUM, Elliot.---*Sparsely-flowered Panic Grass.*

Stems upright, from one to two feet high, rough, open panicle. Flowers in June and July.

It is peculiar to swampy, boggy soils, and is of no value.

PANICUM FILIFORME, L.--(*Slender Crab Grass*).

Loves silicious soil; the plant is very smooth and delicate, the spikes 2-6, erect and filiform like the culm spikelets in two or threes, all pedicellate. Leaves 1-2 inches long, smooth underneath, sometimes a little hairy above, upper sheaths smooth, the lower ones sparsely clothed with fine spreading hairs. It is annual, like the preceding ones, but more succulent.

The above species of Panicum all bear their spikelets crowded 2-3 together in simple and mostly one-sided clustered spikes or spike-like racemes, wholly awnless and pointless; lower flower neutral, of a single palet, lower glume minute, sometimes obsolete or wanting. They are also known under the name Digitaria, (Gray).

The next division, Panicum proper, bears spikelets scattered in panicles, awnless.

PANICUM AGROSTOIDES, Sprengl.--- (*Agrostis-like Panic Grass*).

Perennial, growing July and August in wet places and very common. Culms 2-3 feet high, leaves forming a tuft at the base of the culm 2-4 lines wide; ligule very short, obliquely terminate. Panicles usually several, the terminal one longest; branches mostly in pairs or somewhat fasciculate, a little flexuous, finally horizantal. Spikelets three-fourths of a line long, mostly purplish, somewhat crowded and one-sided, smooth. Lower glume about half the length of the upper, very acute. Palea of the perfect flower slightly bearded at the tip. Cattle eat it.

PANICUM AUTUMNALE--(*Autumnal Panic Grass*).

This is similar to the last, but has branching slender stems, and only grows about one foot high. It is found on sandy hillsides, and old fields. Of no value as a grazing grass, though eaten when nothing better presents itself. Similar to this is the

PANICUM AMARUM, Ell.--(*Bitter Panic Grass*).

It is very like the preceding, and grows almost every-

where in the United States. It affects, however, the banks of streams especially. From its bitter taste it is not eaten by stock.

PANICUM ANCEPS, Michx.--(*Variable Panic Grass*).

Stems flat, from two to three feet high; spikelets panicled or recomed sometimes spiked; glumes two, the lower one short, and sometimes wanting. Worthless.

PANIUM PROLIFERUM, L.--(*Proliferous Panic Grass*).

Annual, growing in wet meadows, river banks. Cattle are very fond of this grass. Culm 1-3 feet long. succulent. Leaves 8-12 inches or more in length, and half an inch wide. Sheaths a little hairy at the throat. Panicles large and pyramidal; the branches much divided, straight and capillary. Lower glume very broad, rather obtuse; upper one acute, about 7-nerved. Perfect flower shorter than the glumes, acute, smooth, anthers orange.

PANICUM CAPILLARE, L.--(*Old Witch Grass*).

Exceedingly common around Nashville. Annual. Culm 1-2 feet high, branching at the base and forming a tuft. Leaves flat 2-5 lines wide, hairy with long fine spreading hairs; panicle large, pyramidal made up from very fine, brittle branches, getting easily diffracted when they become old. Spikelets very small. Old fields when covered with it look like a smoke or haze were spreading over them. Cattle will not touch it.

PANICUM LATIFOLIUM--(*Broad-leaved Panic Grass*).

Perennial. Common in barrens, especially in moist thickets around Nashville. It stands in full vigor in May. A very good pasture grass, bearing the closest grazing, and constantly reviving. Unfortunately it prefers to live scattered intermixed with other plants, not socially.

Culm 1-2 feet high, simple or somewhat branching. Leaves 3-4 inches long, and an inch or more in breadth, cordate and clasping at the base, commonly smooth, but often hairy, spreading horizontally, sheaths about half the length of the internodes, ciliate at the throat, or on the entire margin. Panicle about 2 inches long, bearing usually but ten spikelets, which are about a line and a half long. Lower glume ovate, loose, upper one strongly nerved.

PANICUM CLANDESTINUM, L.--(*Hidden-flowered Panic Grass*).

Perennial. Similar, and growing intermixed with the above, but a month later. Culm with short axillary branches, 1-3 feet high, very

leafy. The leaves broadly lanceolate, somewhat cordate, but not clasping at the base, 3-6 inches long, and an inch or more in breadth, spreading, strongly nerved. Panicles few flowered, terminal or lateral, the former either wholly concealed or only partly exserted. Glumes acute. Lower flower with inferior palea resembling the glumes, upper palea membrauaceous, oblong, obtuse, about two-thirds the length of the lower one Perfect flower triandrous, anthers and stigma purple. Valuable.

PANICUM DICHOTOMUM L.--(*Polymorphus Panic Grass*)

Perennial, growing in copses and woods, flowering and growing all summer and fall. During its growth it assumes a very variable habit.

Culm 8-24 inches high, at first simple, mostly erect, but sometimes procumbent, especially when growing in tufts in open places; smooth or pubesent. Radical leaves, short and very broad, often purplish and usually smooth. Primary panicle more or less exserted, and usually rather compound, the branches mostly flexuous. Late in the season this panicle breaks off, and the culms produce branches which are usually fastigiate and crowded with small simple panicles either exserted or partly concealed among the clustered leaves. Spikelets very small, about one-half line long, obtuse. In shady thickets it grows sometimes 2-3 feet upwards in crawling and scrambling between bushes. Medium quality.

PANICUM VIRGATUM, L.--(*Tall smooth Panic Grass*).

This species grows in wet and sandy soil, one of the largest of the indigenous Panicums. Sometimes it attains a hight of seven feet, leaves very long, flat of a yellowish tinge when old; spikelets about two lines long; branches of the compound, loose and very large panicle, (9 inches to 2 feet) drooping. Not valuable. Flowers in August.

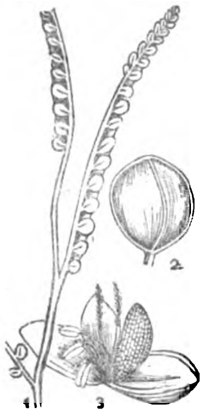
PANICUM CRUS GALLI, L.--(*Barn-yard Grass*).

Likes manured soil, occurs everywhere in yards, ditches and miry places. Annual; Culm 2-3 feet high, stout, erect or somewhat procumbent; leaves ½ inch or more in breadth. Panicle dense, pyramidal, the spikelets crowded in dense, spike-form racemes. Glumes acute, awned, or awns wanting. Glumes and lower palea hispid, rhachis bristly; sheaths smooth. Medium quality—rough food. Eaten by cattle.

PASPALUM, L.--(*Paspalum*).

The various species which represent this genus within the border of the State of Tennessee, rank, in my opinion, fore-

most by the number of individuals, nutritious qualities and tenacity of life, amongst the whole of the grazing herbage. They are perennials, with thick, strong, running roots, often making a dense matting. Wherever they take hold other plants disappear. The blue grass is specifically known to the farmer, and he recognizes it amongst other wild-growing species. The manifold other species waving their culms in the breeze or creeping along the ground, he is accustomed to speak of as wild grasses, and to pass over them without any especial care or notice. Should he once be able to discriminate those superficially resembling forms, he would certainly pass a very different judgment about the relative importance of the blue grass and the other native species. Blue grass and Paspalum are frequently intermixed, but the latter succeeds the former by four to five weeks, and comes in full force after the former has long perished away. Of the twelve species known to exist in the Southern States, seven have been found in this State. They are vigorous growing, succulent grasses, with heavy culms, large and smooth seed grains, with a smooth and thin epidermis. They must surely be very nutritious, and their habit under cultivation ought to be studied.



· Inflorescence Paspalum laeve (1); a closed spikelet magnified (2); the same with the parts displayed (3).

PASPALUM FLUITANS, Poir.--(*Floating Paspalum*).

Annual; growing in swampy places along Cumberland river. Its appearance differs from the rest of the genus, from the arrangement of the spikes in a simple raceme. It is rare, and for that reason of no importance.

PASPALUM LAEVE, Michx.--(*Smooth Paspalum*).

Perennial; flowers in August. Inhabiting open, grassy, moist places. Culms upright, 1-3 feet high; the pretty large and long leaves, with

their flattened sheaths, smooth or somewhat hairy; spikes 2-6, the lateral ones somewhat approximated near the summit of an elongate naked peduncle, spreading; 2-4 inches long, smooth, except a bearded tuft at their base; spikelets broadly two-awned, over one line wide.

PASPALUM CILIATIFOLIUM, Michx.--(*Hairy Slender Paspalum*).

Perennial. With the former, flowers in August and September. Culm mostly prostrate, 1-2 feet long, smoothish. Leaves about two lines wide, commonly very hairy and ciliate on the margin. Peduncle of the terminal spike 2-6 inches long, arising from the uppermost sheath. From the same sheath usually proceeds another spike, on a much shorter peduncle, but sometimes it is only partially or not at all exserted. Rhachis very narrow, convex on the back, hairy at the base. Spikelets two on a short forked pedicel, which is closely appressed to the rhachis, less than a line in length. Perfect flower as long as the glume, very smooth and shining.

PASPALUM DIGITARIA, Poir--(*Finger-shaped Paspalum*).

Culms ascending 1-2½ feet high, spikes slender, rather sparsely flowered, 1-4 inches long, both sessile at the apex of the slender peduncle; spikelets ovate—lanceolate, 2 lines long; common in the barrens.

PASPALUM DISTICHUM, L.--(*Joint Grass. Perennial.*)

In wet places sometimes partly submerged. Nearly glabrous, nearly glaucous; culms ascending, about one foot high from a long, creeping base; leaves linear—lanceolate, spikes short, 1-2 inches long, closely flowered, one shortly peduncled, the other sessile; rhachis flat on the back; spikelets ovate, slightly pointed, about 1½ line long. Frequent around Nashville. Excellent forage; cattle very fond of it.

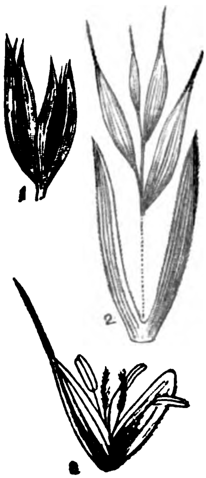
Paspalum Racemulosum and Undulatum are two species resembling the former very much; the one is a perennial, the other an annual, and are good pasture grasses.

GYMNOSTICHUM HYSTRIX, Schreb.--- (*Bottle-brush Grass.*)

Belongs to the tribe of Hordeaceæ, of which our wheat and barley are also members. It bears a general resemb-

lance to them. Spike loose, the spreading spikelets tipped, with an awn about one inch long. Root perennial. The foliage of the tufts is very tender before appearance of the culm. Flowers in July, and is very common in the State. Good forage.

ELYMUS VIRGINICUS, L.--(*Virginian Lyme Grass. Wild Rye. Perennial.*)



The two spikelets of one joint of the spike of E. Virginicus, about the natural size (1); the glumes and the flowers of one spikelet, enlarged and displayed (2); and an open flower more magnified (3).

Spike erect, dense and rigid, spikelets in pairs, 2-3 flowered, the flowers nearly smooth, glumes lanceolate, strongly nerved, as long as the spikelet. Culm 2-4 feet high. Forms large tufts of broadly liner bright green, rough leaves, which commence putting out in March, and afford a good early pasturage. It is very valuable, and ought to be tried in cultivation.

ELYMUS STRIATUS, Willd.--(*Small Lyme Grass*).

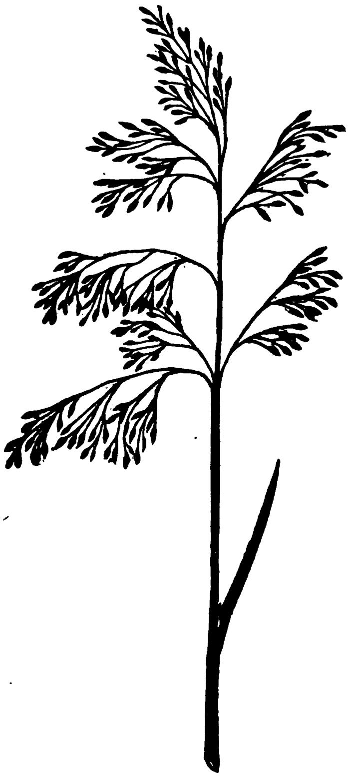
Pubescent or villous; spike dense and thickish, upright or slightly nodding; spikelets in pairs, 1-2 flowered, bristly hairy; glumes awl-shaped, bristle—awned, 1-3 nerved, about twice the length of the flowers, exclusive of the capillary awn, which is about 7 inches long. Very common in dry, sandy places. Poor grass.

ELYMUS CANADENSIS.--(*Canadian Lyme Grass. Wild Rye*).

Perennial, common, flowering in July. Spike loose, nodding at the extremity; glumes lanceolate, subulate, awned, prominently nerved. Culms 3-4 feet high, spike 6-8 inches long. Glume strictly one line wide.

As good as E. Virginicus.

AIRA CAESPITOSA L.--(*Tufted Hair Grass.*)



Stems erect, round, rough, and in tufts; leaves flat, linear, acute, sheaths striated, roughish, the upper one longer than its leaf, pyramidal, oblong; panicle large and drooping, but becomes erect as it ripens, and its branches spread in every direction. Short awns. It is like the "Wood hair grass," only in the latter the awn of the lower floret does not protrude beyond the glumes.

It is peculiar to marshy lands especially where water stands, and may often be seen in meadows or pastures, forming large unsightly tussocks over the field. Cattle will not eat it at all.

DANTHONIA SPICATA, Beauv.--(*Wild Oat Grass*).

Is a perennial grass, with short leaves, narrow sheaths, bearded; stem one foot high, slender, panicle simple; spikelets seven flowered; lower palet broadly ovate, hairy on the back, longer than its awl-shaped teeth.

Dry sterile soil, one of the earliest grasses. April.

HORDEUM PRATENSE, Huds.--(*Squirrel-Tail Grass*).

A low, 6-18 inches high grass, looking much like barley. It is an annual. Not particularly valuable.

ARUNDINARIA MARCOSPERMA, Michx--(*Large Cane,*) and **ARUNDINARIA TECTA, Michx.**--(*Small Cane*).

Are very generally known, and have already been mentioned.

UNIOLA LATIFOLIA Michx--(*Broad-leaved Spike Grass*).

This is a very graceful grass, well-known to ladies for making winter bouquets. Flowers in July on cliffs and river banks. Leaves nearly one inch wide, spikelets large, ¾ inches long and ½ broad, very flat, looking like compressed, ovoid, drooping from long capillary pedicels. Of little valu for forage.

UNIOLA GRACILIS Michx.--

Another very different looking species, deserves no discription.

TRITICUM REPENS, L.--(*Couch Grass.*)

Spikelets, 4-8, flowered, glabrous or nearly so, glumes, 5-7-nerved, rhachis glabrous, but rough on the edges. Occurs here and there in fields and gardens. Very troublesome.

TRITICUM CANINUM, Linn--(*Fibrous-rooted Wheat Grass*).

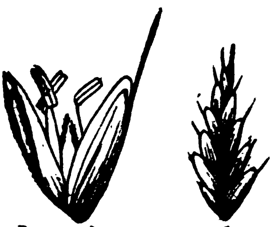
Spikelets four to five flowered; glumes 3-5 nerved; rhachis rough and bristly on the edges; awn twice the length of palet, leaves flat and roughish.

It resembles very much the "Couch" grass, only it has no creeping roots like the latter. It is perennial, and is usually found in cultivated fields. It grows from two to three feet high, and flowers in August. It is greedily eaten by stock, but its habit of spreading in grain fields renders it rather a pest than useful. Its occurrence here is doubtful.

CHAPTER XIX.

BROMUS—FESTUCA—POA—ERAGROSTIS—EATONIA— DIARRHENA—ELEUSINE—MELICA—GLYCERIA—GYMNOPOGON—ARISTIDA—STIPA—CYNODON—BOUTELOUA — MUHLENBERGIA — SPOROBULUS — VILFA — CINNA — AGROSTIS—BROMUS—ZIZANIA—LEERSIA.

BROMUS L.--(*Brome Grass.*)



Bromus. 2 1

A spikelet of Bromus Secalimus, (1); a separate flower enlarged, (2). Spikelets 5, many flowered, panicled, glumes unequal, membranaccous, the lower 1-5, the upper 3-9 nerved, lower palet either convex on the back or compressed, keeled, 5-9 nerved, awned or bristle-pointed from below; mostly two cleft tip. upper palet at length adhering to the groove of the oblong or linear grain. Stamens three.

BROMUS SECALINUS, L--(*Cheat or Chess*).

Common in wheat fields, but too well known.

BROMUS RACEMOSUS, L--(*Upright Chess*).

Occurs with the above. The panicle of the first is always spreading, the one of the second narrowly contracted in fruit.

BROMUS MOLLIS, L--(*Soft Chess.*)

Also in wheat fields; the whole plant soft, downy. They are all three annuals, adventitious from Europe. Troublesome weeds as they are in wheat fields, if sown for themselves, they will make very heavy crops of hay, and will be eaten by cattle.

BROMUS KALMII, Gray,--

Is the only indigenous kind. Perennial. Culms 2-3 feet high. Panicle 3 inches long, the branches short and nearly simple, spikelets drooping on capillary peduncles, closely of 7-12 flowered, densely silky

all over; awn only one-third the length of the lance—oblong flower. Dry ground, scattered in the woods. Ought to be tried how it does under cultivation.

BROMUS CILIATUS, L--(*Ciliated Broom Grass*).

Has a compound panicle, loose, nodding, spikelets seven to twelve flowered, flowers tipped with awns less than their length, leaves large. Culms three to four feet high. Grows in old fields Worthless.

FESTUCA, Linn--(*Fescue Grass*).

A spikelet of F. elatior enlarged (1); a se : ı ı flower (2); lower part of a lower palet outspread, (3).

Spikelets 3; many flowered, panicled or racemose; the flowers not webby at the base. Glumes unequal, mostly keeled. Palets chartaceous, or almost coriaceous roundish on the back, more or less 3-5 nerved, acute pointed. or often bristle-awned from the tip, rarely blunt; the upper mostly adhering at maturity at the enclosed grain. Stamens 1-3, flowers and leaves often dry and harsh

FESTUCA MYURUS, L, and FUSTUCA TENELLA, Willd.

Are both annuals, growing single, flowers awned, panicle contacted. They appear early and make good sheep pasture.

FESTUCA ELATIOR, L--(*Tall Fescue Grass*).

Perennial, growing in wet grass lands; panicle narrow, contracted before and after flowering, erect, with short branches; spikelets crowded 5-10 flowered; flowers rather remote, oblong, lanceolate.

FESTUCA NUTANS, Willd--(*Nodding Fescue Grass.*).

Perennial; 2-4 feet high, growing in copses. Panicle of several long and slender, spreading branches, mostly in pairs, drooping when old, rough, naked below the spikelets, on pretty long pedicels. It is a strong looking grass It never grows gregarious. Both these species are eaten by cattle and are of medium quality.

FESTUCA OVINA, L--(*Hard Fescue Grass.*)

Is a low growing perennial. with a contracted one-sided panicle, grows gregarious, often covering extensive patches. Excellent for sheep; flowers in May The Fescues have been described in "pasture grasses."

POA, L.--(*Meadow Grass*).

Panicle of Poa compressa, reduced in size (1); a magnified spikelets (2); a separate flower more magnified (3); a lower palet cut across and somewhat outspread (4),

· · 3 o vate or lanceolate, laterally compressed, several; 2-10 flowered in an open panicle. Glumes mostly shorter than the flowers; the lower smaller. Lower palet membranaceous; herbaceous, with a delicate scarious, margin; compressed, keeled, pointless, 5 nerved, (the intermediate nerves more obscure or obsolete), the principal nerves commonly clothed at and towa ds the base with soft hairs; upper palet membranaceous, 2, toothed; base of the flower often cobwebby. Stamens 2-3. Stigmas simply plumose. Grain oblong, free. Culms tufted from perennial roots, except Poa annua. Leaves smooth, usually flat and soft.

The softness and greater roundness of the spikelets, the absence of bristle awned tips, the open pyramidal panicle give this genus a habit which distinguishes it readily from the allied genus Festuca.

Besides the species formerly described with the cultivated grasses, there remain to mention:

POA ALSODES, Gray--(*Leafy Meadow Grass.*)

The uppermost leaves often sheathing the capillary branches of the loose panicle, which generally stands in threes or fours. Lower palet very obscurely nerved, villose on the keel below. Woods. Flowers in April and May. It is a scattered growing grass.

POA SYLVESTRIS, Gray--(*Sylvan Meadow Grass.*)

Spikelets very small, loosely 2-4 flowered. Culms flatish, erect; branches of the oblong pyramidal panicle short, numerous, in fives or more. A very light and tender grass, growing scattered through the woods. May.

POA DEBILIS, Torrey--(*Weak Meadow Grass*).

Panicle loose, few flowered, somewhat spreading; the branches mostly in pairs, flexuous, a little rough; spikelets ovate, obtuse, 3 flowered; the flowers webbed at the base, smoothish lower palea oblong, obtuse, slightly 3-nerved; leaves and sheaths smooth; ligule, oblong, acute. Perennial. Flowers in May; a soft eatable, but too scattered growing grass.

ERAGROSTIS CAPILLARIS, Ness —(*Hair-panicled Meadow Grass.*)

Spikelets small, two to four flowered, greenish and purplish, leaves and sheaths hairy; panicle loose, delicate and spreading and one to two feet long.

It flowers in August and September, and grows in poor waste places. May be used in dried flower bouquets.

ERAGROTIS TENUIS, Gray--(*Delicate Spear Grass.*)

Glumes awl-shaped and very acute; lower palea three-nerved, leaves from one to two feet long; panicles very loose, one to two feet long. Flowers from August until frost sets in.

It grows on rich sandy soil, and is of no value for grazing. Exceedingly common on river banks.

ERAGROTIS PURSHII, Schrad--(*Southern Eragrostis*).

Has a lengthened, widely spreading panicle, very loose; branching stems spikelets two to seven-flowered; glumes and lower palea acute. Flowers in August. Nashville. No value.

ERAGROSTIS MEGASTACHYA, Link--(*Pungent Eragrostis.*)

Flowers in August or September, and emits a sharp, pungent odor, when fresh, hence its name. It grows on sandy fields; Nashville in all gardens as a weed. It is rejected by stock.

EATONIA Raff, (Eatonia)--

Spikelets usually 2-flowered, and with an abortive rudiment or pedicel, numerous in a contracted or slender panicle, very smooth. Glumes somewhat equal in length, but very dissimilar, a little shorter than the flowers; the lower narrowly linear, keeled, 1-nerved; the upper broadly obovate, folded round the flowers, 3-nerved on the back, not keeled, scarious margined. Lower palet oblong, obtuse, compressed, boat-shaped, naked, chartaceous; the upper very thin and hyaline. Stamens 3. Grain linear oblong, not grooved.

EATONIA PENNSYLVANICA, Gray- (*Pennsylvanian Eatonia.*)

A perennial and slender grass with simple and tufted culms, polished and shining spikelets like no other of the indigenous grasses. It grows plentifully in Middle Tennessee, loves borders of woods and thickets. Cattle seem to prefer it to any other pickings in the woods.

DIARRHENA, Raff.--(*Diarrhena*).

Spikelets several flowered, smooth and shining, one or two of the uppermost flowers sterile, glumes ovate, much shorter than the flowers, coriaceous; the lower one much smaller. Lower palet ovate, convex on the back, rigidly coriaceous, its 3 nerves terminating in a strong and abrupt cuspidate or awl-shaped tip. Squamulae ovate, ciliate. Stamens two. Grain very large, obliquely ovoid obtusely pointed, rather longer than the palets, the cartilaginous, shining pericarps not adherent to the seed. A nearly smooth perrennial, with running rootstalks, producing simple culms, 2-3 feet high, with long linear lanceolate flat leaves towards the base, naked above, bearing a few short pedicelled spikelets in a very simple panicle.

DIARRHENA AMERICANA, Beauv.

American Diarrhena, is the only species frequent in our woods, and in quality as food about equal to the cheat.

ELUSINE INDICA, Gaert.—(*Crab Grass—Yard Grass*).

Spikelets 2-6 flowered, with a terminal naked rudiment, closely imbricate-spiked on one side of a flattish rhachis; the spikes digitate. Glumes membranaceous pointless, shorter than the flowers. Palets awnless and pointless; the lower ovate, keeled, larger than the upper. Stamens 3. Pericarp containing a loose oval, and wrinkled seed. Culms oblique compressed and flat at the base. Spikes 2-4.

It is found in every garden, around every house, and is spread over most parts of the world. It is an annual, but its roots holds so firmly to the soil that it is difficult to pull it up with the hand. It forms very good and lasting picking for all stock. It is also called Wire-grass or Dog's-tail.

MELICA MUTICA, Walt.—(*Blunt-spiked Melica*).

Spikelets one-five flowered; glumes convex, obtuse, and large. Stamens three, panicle loose, smooth and simple. On cliffs and in copses, 1½-2 feet high, soft and eatable. One of the earliest spring grasses.

GLYCERIA PALLIDA, TRIN.--(*Pale Manna Grass*).

Panicle erect, with hairy branches; has few, linear, oblong spikelets, from five to nine flowered; lower palea oblong, minutely five-toothed; short, sharp-pointed, pale-green leaves; stems creeping at the base, from one to two feet long.

It grows in shallow water, or very wet, boggy places, and is of no agricultural value whatever, as it will not grow on good, dry soils.

GLYCERIA CANADENSIS, L--(*Rattlesnake Grass.*)

Has a spreading panicle, oblong, pyramidal, with drooping spikelets, six or eight flowered, long rough leaves, creeping perennial root, palea awnless, the lower rounded on the back, and flowers in July.

It resembles quaking grass very much; in swampy places, and rises from two to three feet high. Doubtful whether it occurs in this State.

GYMNOPOGON BREVIFOLIUS, Trin--(*Short Leaved Beard Grass*).

Spikelets on long stalks, flower bearing only above the middle, lower palea short awned, glumes pointed, leaves short, flat and thick, stigmas purple, pencil shaped; stamens three.

This is a very rare grass. Found near Tullahoma.

ARISTIDA GRACILIS, Ell.--(*Slender Triple-awned Grass*).

Culms slender, erect, 6-18 inches high with a spike-like virgate panicle; the eaxerted lateral awns one third-one half the length of the horizontally bent middle one.

Sandy soil on open sunny places, very small and thin. July—September.

ARISTIDA DICHOTOMA--(*Poverty Grass*).

Spikelets small, on short contracted racemes, closely crowded together, very small awns at the sides of the palea, the middle one bent down. Grows in tufts, stems greatly branched, and is from one foot to eighteen inches high.

It is called poverty grass because it is seldom seen except on old barren fields, too poor for cultivation, and contains no nutriment.

STIPA AVENACEA, L--.(*Black Oat Grass*).

It stands generally about two feet high, has an open panicle, and its leaves are almost like bristles. Palea blackish, nearly as long as the glumes, terminated by an awn that is twisted below and bent above. The spikelets are one-flowered, and the flowers are borne on a very slender stalk. It is a perennial grass.

Not frequent in this State. Near Charleston, Bradley Co. Completely worthless. July—August.

The Bermuda grass, formerly described, and the dispisable *Burr Grass*, (Cenchrus), are extremely frequent on the shifting sands of the Mississippi river.

BOUTELOUA, Lagasca.--(*Muskit Grass.*)

Boutelona.

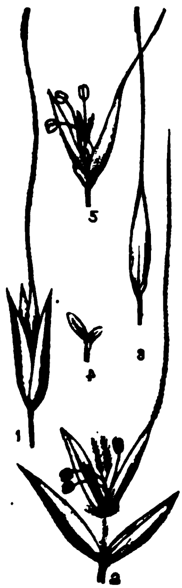
Spikelets crowded and closely sessile in two rows on one side of a flattened rhachis, comprising one perfect flower below and one or more sterile or rudimentary flowers. Glumes convex keeled, the lower one shorter. Perfect flower with the 3-nerved lower palet 3-toothed, or cleft at the apex, the 2-nerved upper palet 2-toothed; the teeth, at least of the former, pointed or subulate, awned. Stamens 3, anthers orange colored or red.

A portion of the compound spike of the natural size, (1); and a spikelet displayed and magnified, (2); the flowers raised out of the glumes.

BOUTELOUA CURTIPENDULA, Gray.--(*Horse Shoe Grass*).

Culms tufted from a perennial root stalk which spreads in a semi-circular form like a horse-shoe. Leaves narrow, spikes one-half inch or less in length, nearly sessile. Flowers scabrous. It grows abundantly in the pine barrens of Middle Tennessee, (Lavergne, Smyrna), and is one of the best pasture grasses.

MUHLENBERGIA, Schreb.--(*Drop-seed Grass.*)



Spikelets one-flowered, in contracted or rarely in open panicles. Glumes mostly ovate, acute or bristly pointed, persistent; the lower rather smaller or minute. Flower very short, stalked or sessile in the glumes; the palets usually minutely bearded at the base, herbaceous, deciduous with the enclosed grain, often equal, the lower 3-nerved, mucronate or awned at the apex. Stamens three.

The most species of this genus look like a diminutive decumbent cane, from the dry, somewhat stiff aspect of the leaves and the hard and polished, really cane-like condition of the stems.

A magnified closed spikelet of Muhlenbergia sylvatica, (1); the same with the open flower raised out of the glumes, (3); its minute and unequal glumes more magnified, (4); and an open spikelet of the same, (5).

MUHLENBERGIA DIFFUSA, Sch.--(*Nimble Will*).

Culms diffusely branched. 8-18 inches high, panicles contracted, slender, glumes extremely minute awns once or twice longer than the palet. August—September. Very abundant.

MUHLENBERGIA GLOMERATA, Trin. --- (*Cluster-Spiked Muhlenbergia*).

Panicle oblong, 2-3 inches long, contracted into an interrupted glomerate spike, long peduncled, the branches sessile, glumes awned. August.

MUHLENBERGIA MEXICANA, Trin. -- (*Mexican Muhlenbergia*).

Culms ascending, much branched, 2-3 feet high, panicles lateral and terminal often included at the base, contracted, the branches densely spiked, clustered, linear. Glumes awnless, sharp pointed. With the former along the borders of creeks and river banks. Abundant.

MUHLENBERGIA SYLVATICA, Torr & Gray. — (*Wood Muhlenbergia*).

Culms ascending, much branched and diffusely spreading 2-4 feet long; contracted panicles densely many flowered; glumes almost equal, bristle pointed, nearly as long as the lower palet. which bears an awn twice or thrice the length of the spikelet. Woods, common. August—September.

All the species of Muhlenbergia are but a very poor forage, and while other things are plenty, they are not sought after. Yet as all of them possess the quality of staying green until late in the winter, they are of great help for stook beating about on cold and dreary winter days. In cultivated grounds they are a great nuisance, their far-reaching, creeping roots being nearly unexterminable.

SPOROBOLUS, R. Br--(*Drop-seed grass.*)

Spikelets one, rarely two-flowered in a contracted or open panicle, the palets longer than the unequal glumes. Stamens, 2-3. Grain a globular utricle (hyaline or rather coriaceous), containing a loose seed which drop out very readily at maturity.

A spike of Sporobolus magnified, (1); the same with the flower open, the palets raised above the glumes, (2); and the fruit, (3), more magnified, showing the seed loose in the pericarp.

SPOROBOLUS INDICUS, Brown--(*Indian Drop Seed*).

Culms erect; panicle elongated, linear; leaves long, flat; palea twice

as long as the glumes, the upper one truncated. Growing in large patches about Tullahoma, Cowen, etc.

All parts of the plant are equally pliant and succulent; it sprouts again, after being pastured down, with numerous new culms, and its growing season lasts from May till frost. The culms stand about 2 feet high, and it is naturally social. As far as I observed I found it always growing in patches. It grows in low and small tufts and sticks firmly to the soil. I would very earnestly recommend to try it under cultivation. In addition to my own observations, I would state that the Agricultural Report for 1870, in a paper on the grasses of the plains and the eastern slope of the Rocky Mountains, after enumerating 142 species of grasses indigenous over that region, and selecting twelve of them as the most valuable of them all, accepts Sporobolus Heterolepis, an allied species, as one of them. It is there said, "This species is peculiarly palatable to cattle, and they are seen roving over rich pastures of other species in search of it. This is also said to be the winter forage species of cattle, where it abounds, affording the rich winter pasturage of the farmers and herders of Kansas. It flourishes chiefly on the moister portions of the plains, and many local areas are almost exclusively occupied by it."

ARRHENATHERUM AVENACEUM, Beauv.----(*Tall Oat Grass.*)

Spikelets open, panicled, two-flowered, with a rudiment of the third flower; the middle awn flower perfect, its lower palet barely bristle, pointed from near the top; the lowest flower staminate only, bearing a long, bent awn below the middle of the back. Looking much like oat. Perennial. Has been tried with good results in cultivation. Flowering in June.

Not very frequent in this State. Old fields, Clifton pike, Nashville.

TRICUSPIS SESLEROIDES, Torr.--(*Tall Red Top.*)

Perennial; culm upright, 3-5 feet high, very smooth, as are the flat leaves, panicle large and compound, the rigid, capillary branches spreading, naked below; spikelets shining, purple.

A showy grass, but too hard to be eaten by stock. Frequent in light soil. July—August.

VILFA VAGINÆFLORA, Torr--(*Southern Poverty Grass*).

Annual, culms slender, 6-12 inches high, leaves, convolute, awl-shaped, 1-4 inches long. Panicle single and spiked, the lateral and often the terminal concealed in the sheaths.

Growing in the poorest places, and in the streets of Nashville.

CINNA ARUNDINACEA, L.—(*Indian Reed.*)

Spikelets, one flowered much flattened, crowded in an open flaccid panicle, glumes lanceolate, acute, strongly keeled. Flower manifestly stalked in the glumes, smooth and naked; the palets much like the glumes, the lower longer than the upper, short, awned or mucronate on the back.

A tall, sweet-scented grass, with ample terminal panicle. Damp woods. Flowering and fruiting, July to October. Worthless.

AGROSTIS CANINA.—L. *Brown Bent-Grass.*

Agrostis Canina.

Has an erect, slender, spreading panicle; creeping, perennial root; slender, erect stem; and linear leaves; glomes longer than the palea, a bent awn on the palea; greenish spikelets, afterwards turning brown, whence its name; flower but one in a spikelet; open panicle; stamens three.

It is a native of Europe, but introduced into the United States where it now is occasionally found in meadows. It flowers in middle summer, and is of no agricultural value. A variety of it (Agrostis Rupestris, *Chapman*) occurs in the higher Alleghany mountains, where it is indigenous.

AGROTIS SCABRA, Willd.—(*Tickle Grass*).

Another species of agrostis, with a loose spreading, purplish panicie, the branches having the flowers near the apex; stems slender, and from one to two feet high; short narrow leaves. It flowers in July.

Its exceedingly delicate panicles when ripe, are easily broken from the stem, and carried away. On this account it is sometimes called "Fly-away-grass." It is of no value.

AGROSTIS PERENNANS, Tuckerm.---*Everlasting Bent-Grass.*

Has a diffusely spreading panicle, pale green; branches short, divided; flower bearing from the middle, perennial.

Doubtful whether in this State. Similar to the Herds grass.

ZIZANIA AQUATICA, L.---(*Water or Indian Rice.*)

This is probably the only species occuring in this State, and this I have never seen yet myself, but from information I believe it to occur quite frequently in West Tennessee. It is a tall growing annual, culms three —nine feet high, leaves flat, two to three feet long. It bears its flowers in a large panicle, the lower branches of which bear the male flowers, and soon drop off, while the upper are female, consisting of two paleas. (glumes are absent in this genus), the lower one oblong, keeled, terminating in a straight awn. Seed terete, about half an inch long, blackish when ripe, but white and farinaceous internally. It grows in swamps, and on the borders of rivulets and lakes, very frequent in the northwest, where its grain is a favorite article of food among the Indians, and cattle are also very fond of the herbage. In inundated regions, which are worthless for other cultivation, it ought to be sown like rice. An acre of it is about equal in nutriment to an acre of wheat.

ZIZANIA MILIACEA, Michx--

If it should occur within our territory, is similar to the foregoing, and a perennial.

LEERSIA, Solander--(*White Grass.*)

Spikelets one flowered, compressed, glumes none. Paleae two, awnless, closed, equal in length, but the lower one much broader, carinate. Stamens 2-3.

LEERSIA ORYZOIDES, Swartz—(*Cut Grass.*)

Panicle branched, diffuse; rhizoma creeping, perennial. Culms 3-5 feet high geniculate at the base. Leaves 2-3 lines wide, very rough, with minute hooked prickles, as are also the sheaths.

Growing in ditches and swamps. September.

LEERSIA VIRGINICA, Willd---(*White Grass.*)

Panicle simple; the spikelets closely appressed on the slender branches, around which they are partly curved; palets greenish white. Wet woods, common. July, September.

LEERSIA LENTICULARIS, Michx---*Fly-catch-grass.*

Spikelets broadly oval, imbricately covering each other, 2½-3 lines long. Smoothish, panicle simple; palets very flat, strongly bristly ciliate, (said to close and catch flies). Wet places with the above, frequent.

Those three species, although they are of no value, are described here for their being frequently met with as peculiar grasses and easily recognizable.

Descriptions of other native forage plants contributed by Dr. Gattinger, will be found in the chapter on Leguminous plants.

MANAGEMENT OF MEADOWS

AND

CONCERNING MANURES.

PART V.

CHAPTER XX.

MEADOWS AND PASTURES—THEIR PREPARATION—DRAINAGE—SELECTION OF SEEDS—TIME OF SOWING—CUTTING, CURING AND SAVING HAY—MANAGEMENT AND IMPROVEMENT OF MEADOWS—MANURES AND MANNER OF APPLICATION.

Meadows exist in various sections of the State to a limited extent, and it being the object of this work to foster this branch of agriculture, the best plans for encouraging and treating them will be discussed. The subject requires no argument to encourage it, as every right-thinking man will see at a glance the great importance of growing more hay. It is, in the observation of every one, that vast amounts of baled hay are brought by rail and river from those States already embarked in the cultivation of grasses. While we have the best climate in the Uuited States for this purpose, as already stated, we have a soil unparalleled for fertility, and well suited to almost all the varieties of grasses described, and, besides, being on the border of the cotton States, we have a market at our doors for our surplus. We

certainly ought to be able to compete with the Northern States with these advantages; and then, to add to our advantages, there is a surplus of labor awaiting our orders. It is true, our labor is not educated, but we can supply that defect by properly educating ourselves so as to meet any of of the requirements necessary to raise these crops. If we do this our country will assume such a charming appearance that it will delight the eye of every passenger who travels through it on the many lines of railroads, besides repaying the owners all the care bestowed on it. Our citizens are not so much to blame for this backwardness in the cultivation of the grasses as would appear at first sight. The routine established before the war was hard to break up, but they are now looking around for some more profitable method of farming. To establish meadows is the part of wisdom. Just how to do this we propose to tell in this chapter more fully than in the introductory chapters. We shall consider:

1st. The preparation of meadow lands.

2nd. Selection of suitable seeds for sowing and method of mixing.

3rd. Times of sowing and the best methods of securing stands.

4th. Cutting, curing and storing the hay.

5th. Improvement of meadows.

6th. Manures and manner of their application.

In our remarks upon the different grasses, the most of the subjects have already, to some extent, been noticed, and therefore, we will be pardoned if some repetition takes place, but the subject is of so much importance that we will be justified by the ends to be attained.

PREPARATION OF MEADOW LANDS.

This is of the utmost importance when we reflect that any want of attention to all the details necessary to insure success involves a considerable loss, not only in money and

labor, but also in the length of time required to undo and correct the error. God sows the pastures to our hands, but man must sow the meadows. A man may think he is pursuing the most judicious course possible, but he may be in error, and an honest mistake does not free the farmer from loss. He must inform himself correctly on the character of the land to be sown, and then, with every facility at his command, acquaint himself with the grasses best adapted to its requirements.

In the first place, though many varieties of grass will grow well on moist land, it is not to be understood that they will thrive best on wet lands. When the water stands on the surface all the year the character of the hay is nearly worthless, being full of moisture and with but little nutritive principles in it. Consequently it is very important to have soils properly drained, if they require it. It will largely increase the quantity and greatly improve the quality of the crop. With the soil full of moisture it becomes sour and, though full of fertility, it is unavailable to the plant. With a wet soil, it is impossible to put the land in a proper state of tilth. So all things point to the necessity of drainage.

It may be proper to state that every piece of ground on which water will stand two hours after a rain will be benefitted by a system of drainage. This seems to the Southerner to be such a stupendous undertaking that nearly every one is discouraged from making the effort. When it is supposed that draining can only be effected by ditching in every direction, and laying great stretches of pipes, the undertaking does seem indeed to be very costly.

The method of pipe-laying is the best, and as our farmers see the good effects of a cheaper method, they will gradually, and by slow degrees, come to practice the more substantial methods. A Northern land owner does not hesitate to spend fifty or seventy-five dollars on a single acre, when he can bring into cultivation a choice piece of bot-

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tom. But the Hollanders surpass every other people on earth in this particular. Nearly every foot of land they own has been reclaimed from the sea by a system of dykes, levees and ditches. Their lands being lower than the water courses that run through them, their only resource is to lift the waters that are collected in the ditches by means of steam pumps. This is done, it is true, at the expense of the public, but the farmers pay an annual tax to keep it up, or they would soon be flooded by the accumulating waters that penetrate the soil from every side. Now, if by this practice, they are able to give one thousand dollars per acre for the land, and pay annual drainage tax to an amount equal to the value of our lands, why may we not pursue the simple act of puttiug our lands in as good condition at a tithe of the cost of theirs?

There are many methods of draining land, but we will confine ourselves to the method ot doing it as effectually as the Dutch, but at such an expense that even a renter can afford it, for the increase of one year's crop. A German gardener of New York leased ten acres of land that proved to be boggy, and the first three years his crops, in spite of all the attention he could give them, barely paid rent and supported him. He was advised to try draining, and although but seven years were left of his lease, he did it at a cost of $500. The result fully justified the expense, for in the remaining seven years he made, over and above all expenses, money enough to pay $12,000 for the farm he had drained. No land can produce well without the aid of heat and proper aeration. If the soil is full of water it will be impervious to the air, and the water will also counteract the effects of the sun's rays, and the ground will be cold and lifeless. Without the influence of heat and air necessary chemical changes in the constituents of the soil cannot take place, consequently the roots fail to find the nourishment they are seeking—they fail to penetrate the soil to a sufficient depth, and instead of a rich subsoil, there will only be surface soil to

support vegetation. That soon becomes exhausted, and the land appears worn out. Draining opens up a mine of fertilizers below, the roots run quickly down to it, and there is no question that the crops are greatly increased. There is much land in our State that would be greatly improved by draining. The soils that will be improved can be ascertained, during the wet season, by digging a hole in the fields and watching the height to which the water rises. In many places it will remain almost on a level nearly all winter; in others showing itself one, two or three feet below it. And this, too, on rolling lands that are supposed to be dry enough. Not only are the wet lands made dryer, but the dry lands made wetter. This is effected by the soil becoming porous, so as to better admit the moisture of rains and dews. It is made warmer, and consequently frosts will have less effect, there being less moisture to freeze on the surface. And besides, by being warmer the crops come on earlier.

Our Northern farmers practice almost exclusively tile draining. This is a costly mode, and if it were the only way our farmers would be frightened at once from the effort. But so thoroughly is this plan practiced that it is no longer an experiment. Some counties in Ohio have spent the public funds in digging and draining the mains so that farmers can lay their drains into them. Wood county, Ohio, in 1867, spent in one year $500,000 in digging mains. One drain was dug 30 miles long, and six feet deep, while the districts dug 400 miles more.

The Agricultural College of Michigan appointed a committee to investigate the effects of draining. They bought twenty-five acres of swampy land, covered with bog-grass rushes, flags and other worthless vegetation. They laid about 800 yards of tiles at an expense of $480, and sowed it in grass. At the first cutting the crop was sold for $1,570, leaving a clear profit, the first year, over all expenses, of $548.70, and the second year they cleared $975. This

was on land that, before draining, produced absolutely nothing.

How many of our Tennessee acres are in a condition to be improved every one can guess. We have wet lands in abundance, not only on our river bottoms, but also on the uplands. These lands are as full of fertility as it is possible for lands to be, and it only requires a small outlay for drainage, to develope and utilize this wealth.

Tiles can be bought at any of the seed stores at about $16 per thousand, and should be put in about three to four feet deep, the last depth being preferred, if there is slope enough to carry off the water. If a branch of water runs through a meadow it can be used as a main, the side drains running obliquely to it. The drains should be constructed so that water will run down them, and not stand in them. The side drains should be laid from thirty to sixty feet apart, according to the amount of water in the soil. The cost is from $50 to $100 per acre. But this is where the only method of ditching to plant the tiles is by a spade at twenty or thirty cents per yard. A much cheaper, and equally effective plan is to select and lay off the points for the ditches, and then, with a long, sharp, bull-tongue plow, run several furrows, with two horses, to the width desired, say eighteen inches or two feet, throw out the loose soil with shovels and then run again with the plow in the same track. When the ditch gets too deep for the plow, fasten a chain to the clevis so as to lengthen the distance from the horses to the plow, making the horses straddle the ditch, and by continuing to lengthen the chain there will be no difficulty in plowing to any desired depth. If this plan is pursued a ditch can be dug at a very insignificant cost, and then the tiles can be laid in the bottom and the ditch filled up.

But a drain can be made in a much cheaper manner than this. Should there be plenty of surface rock near, lay one on the bottom of the ditch, one on each side of the bottom

rock, and cover with a fourth. Or instead of using four rocks, a very good ditch can be made by tilting two flat rocks to each other so that a transverse section will form an Λ shaped tunnel, and if there is a firm bed to the ditch it will last an indefinite length of time, the water carrying off the loose crumbs of clay.

Still another plan is to use, instead of the rocks, poles of any kind of wood, so they are straight. Lay two poles, say four or five inches in diameter, parallel to each other, leaving a space of six inches between them, and then lay another pole on the centre space so that its edges will rest on the other two, leaving an open space five or six inches in diameter. Then throw stubble, straw, weeds, leaves or cornstalks over the poles, and indeed over the rocks also, and there will be a good ditch without the outlay of any money. Of course the loose dirt will be thrown over either the rocks or logs. Timber under ground in this way will last a long time.

But there is still another plan, in case the soil has any descent, and there are few lands in Tennessee without it, and that is by means of a subsoil plow. Let a stout subsoil plow follow in the furrow of a turning plow, both drawn by stout teams, and send the subsoiler at least two feet deep. Let the furrows run up and down the hill so as to give a regular descent to the water, and the hard pan broken up by the subsoil will carry off all superfluous water after rains in a very short time. This process is so effective that it is pursued in some sections to the exclusion, entirely, of regular draining. It will have to be repeated at intervals of three or four years, and there will be but little disturbance to the sod, as the subsoiler has only an iron bar for a helve, which raises the surface so slightly it can easily be pressed back with a roller.

It may be truly said that by this system, properly followed, we extend our acres perpendicularly instead of laterally, which is the true theory of cultivation. Man owns

the land from the surface to the centre, but how few ever utilize these under-ground acres. From all the testimony to be gathered on this subject, it is pretty apparent that the cost of draining a meadow will be paid the first year by the increased production of the crop. The after-crops will be profits of the farmer.

Now, it being understood the land is in a sufficiently dry condition, either by draining or naturally, the next thing is to put it in a state of tilth. After what has been said in regard to almost every kind of grass, it is almost needless to impress on the mind of the farmer the necessity of thoroughly pulverizing the soil.

Let it be well and deeply broken up, and then with the harrow, drag and roller continue to work it until it is smooth and not a clod appears on the surface. The roots of grasses are exceedingly delicate and cannot penetrate the hard, dry lumps of soil, but will exhaust their energies in going around or under them. Besides, in exactly the same proportion as the clods exist, are the nourishing elements locked up from the use of the grass. Another reason: when clods exist in great numbers, the ground will be rough and the seed will not get into the soil, or will get in too deep to germinate. Thus seeds are lost and the stand impaired.

It is needless to say the soil must be fertile, for nothing will thrive well on poor soil. If it is not rich it must be made so. Should it be desired to sow a field that has been greatly exhausted, a plan pursued in England is commended. The fall previous to sowing, the field is put in turnips. During the winter, by means of hurdles, a flock of sheep is confined to a portion of the field, and they are not allowed to leave until every vestige of the turnips is exhausted. By this time the ground will be black with their droppings. In this manner the whole field, acre by acre is gone over and the ground has a fine covering of manure. We will suppose this consumes the winter. In the spring break up, or to break up just as soon as the sheep

are removed is better, and sow with peas. When this crop is in full bearing let on both hogs and sheep, and it will amply repay all its preparation by the manner in which the stock will thrive, and they will again bestow on it a cover-ering of fine manure. Now the ground is well manured and fully capable of giving, in return for the care bestowed, a bountiful crop the first year. Of course it must be again broken and pulverized as before mentioned. This not only pays better than letting it lie in fallow, but it keeps down weeds. When ground is fallowed, there will be generally an interval of neglect, and the weeds, ever watchful for a chance, will spring up, mature their seeds and sow them, to the trouble and vexation of the farmer afterward.

SELECTION OF SUITABLE SEEDS AND BEST METHOD OF MIXING THEM.

Whatever the character of the soil to be converted into a meadow, a suitable grass will be found in our list. There are grasses for rocky land, sandy land, bottom land, upland, or calcareous land, and we cannot do better than to refer the reader to the large list from which to select, as the kind of land to which they are adapted is clearly shown in each descriptive article.

It is well known to every farmer that some grasses will not thrive on certain characters of soil. What grasses to sow must be left to the judgment of the farmer, as only an extended experience will be able to show under every circumstance the peculiarities of the land to be sown. Under certain conditions, too, it may be preferable to put the land down in clover, whatever kind of soil it may be, especially is this the case where the land from long cultivation is not in good heart. It must be remembered that, if a field has, by long-continued cultivation, without rotation, been so reduced in fertility that it will not produce remunerative crops, it will not produce any kind of grass in paying quantities, until some of its vitality has been re-

stored. If a farmer fattens stock from the produce of his farm, it follows that whatever goes to produce bone, muscle, and blood, is so much substance taken from the soil and restitution is demanded.

When the earth is covered with grasses, and they are plowed under, and converted into vegetable mould, not only does the land receive what has been taken from it, but there is added, a vast amount of substances extracted from the atmosphere, such as carbon, ammonia, nitrogen and oxygen, and in that way the land is constantly improved. It is in this way that nature renews herself, and a piece of land left to her care, will, after the lapse of a few years, regain its lost fertility. But the necessities of man are such he cannot await this slow process, and therefore, it is that he must, to bring about the same result sooner, resort to the expedient of plowing in green crops. Various kinds of green manuring crops are used for this purpose. In the selection of a crop to plow under, one thing should be kept prominently in view, and that is select such crops as derive their nourishment in great part from the air. It has been demonstrated by many experiments that the Leguminæ do this more effectually than any other class. Among these none are so effectual as the different kinds of clover. They not only enrich the land by the great mass of foliage and stems, but also by their penetrating roots, that by their mechanical displacement of the soil, loosen and pulverize it. Next to the clovers are peas. They, it is true, do not have the same extensive system of roots, but, if possible, they grow and exist more from atmospheric influences than any other plant. They will thrive and make good crops on poorer soils than any other kind of vegetation; and if a year or two is spent in sowing in peas and plowing the crop under the soil will be made fertile enough to receive a permanent coat of grass, for we know that the atmosphere is full of those elements so essential to vegetation. Man can only

avail himself of these fertilizing qualities by the aid of such substances as embody them in their own growth. In this way he is able to secure them and place them back in the soil.

After the selection of the kinds of grass to be sown the next consideration is to select good seed. How often has it occurred to every farmer to see the result of all his toil and expense culminate in failure for want of good seed! It does not always occur to the sower that his seeds are defective through age, or through mixing noxious seeds with the grass seeds. The high price that seeds command is a great temptation to the dishonest dealer. Sometimes it happens that good seeds are kept until they have lost their power of germinating. If it be possible, it is far better to save seed from the farm itself. It involves but little care to do so, and is an actual saving to the farmer, and then he knows what he is sowing. Should it be necessary, however, to buy seeds, always delay a few days to test them. This is easily done by placing a certain ascertained number on a wet cloth, folded several times to retain moisture, and covering them over with a single thickness of the same. Keep the cloth damp a few days and the good ones will swell up and sprout while the defective ones will be covered over with mould. Count the sprouts, and by an easy computation, one can then ascertain the proportion of good seeds. Then sow in the proportion and there will be no difficulty in securing a stand. The wisdom of this precaution may be known when it is stated that nearly all the grass seeds are worthless at the end of three years, only a small proportion of them germinating. Even clover seeds that will keep their vitality when in the ground, and covered up, will lose this vitality in four or five years, if exposed to the atmosphere. The millets are scarcely worth sowing after the second year. The selection of the species being determined on, the next consideration is the propriety of mixing or sowing alone, and in this connection, the best argument in favor of mixing should be taken from nature.

No pasture, however luxuriant, is found to consist of one grass alone. In all meadows sown alone, there will be found naked spots, and these seem to depend upon some incompatibility of the soil, at that point, with the grass sown. These spots would be occupied possibly by other species if sown, and thus the whole surface would be covered. Some grasses are disposed to turf the ground while others form tussocks, therefore it is best to mix, if sowing a tussock grass, a grass that will turf well. Some grasses have a heavy under-growth of surface foliage while others have this sparingly. These two peculiarities would be done away with if the two were combined.

It is not, however, proper to combine the pasture grasses with the meadow grasses. As a rule the former have creeping roots and are more vigorous than the latter, and they would soon overpower them and destroy the meadow. This, of course, is spoken in reference to the perennial pasture grasses.

Another condition of mixing is the number to be combined. As a rule, it is beyond question, that a meadow sown with a variety of seeds will do better and make more hay than when one kind is used. It is no easy matter to explain why, but nature does it, and she rarely errs in her primitive growth. To show the variety of growth on a piece of natural meadow, the following table is given, which was made from a careful count by Mr. Sinclair. It shows that the greater the number of species, the greater the number of plants to the square foot, and where the species are reduced the number of plants also decrease. The soil should be supplied with seed enough to suit every constituent in it, and then if one fails another may answer the purpose, and the difference in cost of a few seed is but a small part to the value of a good meadow.

AVERAGE NUMBER OF PLANTS AND SPECIES TO THE SQUARE FOOT OF SWARD.

CHARACTER OF THE TURF.	Whole number of Plants on the square foot.	Natural grasses.	Clover and other plants.	Distinct species.
1. A square foot taken from the richest natural pasture capable of fattening one large ox or three sheep to the acre was found to contain....	1000	940	60	
2. Rich old pasture capable of fattening one large ox and three sheep per acre..............	1090	1032	58	
3. Another old pasture contained............	910	880	30	12
4. An old pasture of a damp, moist and mossy surface	634	510	124	8
5. A good pasture, two years old, laid down to rye grass and white clover..................	470	452	18	
6. A sod of narrow leaved meadow grass (*Poa angustifolia*) 6 years old...................	192			1
7. A sod of meadow foxtail by itself 6 years old...	80			1
8. Rye grass by itself 6 years old...........	75			1
9. Meadow irrigated and carefully managed..	1798	1702	96	

It will be seen by this table that numbers 1, 2 and 9 have more varieties of grasses than any others, and according to the table, are more thickly covered with plants.

A custom prevails among the grass farmers of the North and East to mix a great number together—some having as many as a dozen different kinds on one meadow. In this way those vacant spots we have spoken of will be filled up with selected seeds, instead of seeds of an inferior or noxious sort. The ground will be covered, and it is better to select the best varieties. The more especially is this the case, when it is expected, as most farmers will do, to pasture, to some extent the meadow, or when it is wished to train it as a meadow a few years, and ultimately let it pass into a grazing lot. It is quite a common custom in this State to mix clover and orchard grass, or clover and herds grass, or clover and timothy, and sometimes timothy and herds grass are mixed, and this is about the extent of mixing done.

In the great meadows of the North Western and New England States where grass culture has been practiced for years it has been demonstrated often that the admixture of several varieties increases many fold the yield of grass, even if not wanted for pasturage. It secures an early stand, and if the ground fails to suit one species another will flourish, and thus, all vacant spots are covered. These spots of even an inch or two may seem insignificant, but when they are multiplied all over a large field they will materially affect the yield. The crop is made up of single stalks, and every stem is of importance in the aggregation.

While we have the best evidence of the good effects of sowing several varieties together, it is strange that farmers of enlarged and intelligent experience will persist in putting down only one kind, unless it be to save seed. No man who has gone over a timothy or orchard grass meadow can help but notice the many vacancies that could be filled. These often occur from freezes, the heat of the sun, birds, defective seed and incompatibility of soils. This would certainly not be the case if attention was directed to its prevention. Nature sets the example, and as a rule she is found to be the most trustworthy teacher.

It is sometimes the case that the land is exactly suited to timothy, herds grass or clover, and by sowing these together, or even separate, we succeed in covering the ground, but this is rarely found to be the case.

It should be kept in mind in the selection of seeds to put those together that will blossom at the same time, unless it is intended for a pasture, in which case the reverse should be considered, for then it is best to so arrange it so as to have a succession of ripening crops, and the stock can be supplied throughout the year with such grasses as will be young, tender and succulent. But in the case of meadows it is desirable only to have such as will ripen together, as otherwise those cut too green will lose greatly by shrinkage. Another care to be thought of, is to put down grasses as nearly alike as possible as regards the aftermath.

Some require or are improved by the tramping of stock. If left to themselves they have a tendency to tuft or spring out of the soil until their roots are exposed, when they fall a prey to the sun or to the freezes. These tufts or tussocks, as they are also called, will leave at least half the ground bare, and thus, also, much of the hay is lost. But if tramped by stock the grass is pressed back into the soil and a turf is kept up that covers the whole surface.

Some of the grasses, however, as timothy, do not require and will not bear grazing, for various reasons. These grasses ought not to be mixed with those that are benefited by timothy, and should such be disposed to tuft, the use of a heavy roller is the only remedy, and the vacant spaces can easily be reset by sowing seeds of the same or other varieties on them, and then giving them a light coat of manure.

It may be assumed that in nearly all meadows or pastures clover should be a constituent. It is an easy matter to secure a stand of it. The clover will, in the course of two or three years, disappear from the meadow, leaving the grass in possession of the ground. But it has not left without a blessing, for it has reached up into the air with its long arms and drawn down great stores of ammonia, nitrogen, carbonic acid, and other valuable elements that grass requires, and has pushed them down into the soil; while on the other hand, it has pumped up immense quantities of potash and other salts that are, in their natural state insoluble, and not available to the grasses, and when it dies, it bequeaths these valuable manures to its successors. Nor is this all. Its long roots permeate the ground to a prodigious depth, for so humble a plant, and when the roots decay the soil is so honey-combed that rains penetrate to the subsoil easily and the grass roots follows to a much greater depth than they could otherwise attain. And while all these services are being rendered the clover is giving to its owner large yields of the best of hay. What a faithful servant is this plant!

Before proceeding to the subject of the proportions in which seeds should be mixed, we will give a table prepared by the Messrs. Lawson, of Edinburgh, the celebrated seedsmen, who have demonstrated the truth of its statements by actual experiments. It contains the weight of seeds per bushels, the number of seeds in a bushel, the depth of soil in inches and fractions of an inch, at which the greatest number of seeds will germinate, the depth of soil in inches and fractions of an inch at which no seeds will germinate, the depth of soil at which half the seeds will germinate, and the average per cent. of loss in the weight of grass in drying, when cut at time of flowering. One thing is to be remarked, and it of the utmost importance too, and that is, seeds are much lighter when dry or old, than when fresh, and therefore, it is better to make a calculation by pounds rather than by measure, as in the case of old, light seeds, more of them by number would be sown, and a better chance for a stand be given in the increased number, and thus an allowance be given for defective seeds.

NAMES OF GRASSESS.	Average No. of lbs. in a bushel.	Average No. of seeds in an ounce.	Depth of soil in inches and fractions of an inch at which the greatest No. of seeds will germinate.	Depth of soil in inches and fractions of an inch at which only half the seeds will germinate.	Depth of soil in inches and fractions of an inch at which none of the seeds will germinate.	Average percentage of loss in the weight of grass when dry, cut in time of blossoming.
White Top...........	13	500.000	0 to ¼	½ to ¾	1	.65
Red Top, Herds Grass...	12	425.000				.63
Tufted Hair Grass........	14	132.000	0 to ½	¾ to 1	2¼	.65
Meadow Foxtail	5	76.000	0 to ½	1 to 1¼	2¼	.57
Sweet Scented Vernal...	6	71.000	0 to ½	1 to 1¼	2	.45
Tall Oat Grass...........	7	21.000	½ to ¾	1¼ to 1¾	4	
Slender Wheat Grass....	10	15.500	0 to ¼	½ to ¾	2	
Crested Dogs tail.......	26	28.000				
Orchard Grass..........	12	40.000	0 to ¼	¾ to 1	2¼	.29
Hard Fescue...........	10	39.000	0 to ¼	¾ to 1	2¼	
Tall Fescue............	14	20.500	0 to ¼	1 to 1¼	2¾	.52
Sheep's Fescue.........	14	64.000	0 to ¼	¾ to 1	2	.65
Meadow Fescue.........	14	26.000	0 to ½	¾ to 1	2½	.60
Slender-Spike Fescue...	15	24.700				
Red Fescue............	10	39.000				
Red Meadow Grass......	13	58.000	¼ to ½	¾ to 1	2¼	.30
Common Manna Grass...	15	33.000				.35
Meaidow Soft Grass.....	7	95.000	¼ to ½	¾ to 1	2½	.73
Ital an Rye Grass.......	15	27.000	0 to ½	1 to 1¼	3¼	
Perennial Rye Grass....	18to30	15.000	¼ to ½	1½ to 1¾	3½	.50
Millet Grass............	25	80.000	¼ to ½	1 to 1¼	2¾	.38
Reed Canary Grass......	48	42.000				.32
Timothy	44	74.000	0 to ¼	¾ to 1	2	.50
Wood Meadow Grass ...	15	173.000				.52
Blue Grass.......... ...	13	243.000				.57
Rough Stalk Meadow...	15	217.000	0 to ¼	½ to ¾	1½	.72
Beach Grass..	15	10.000	½ to 1	1½ to 1¾	4	
Yel ow Oat Grass......	5½	118.000	0 to ¼	¾ to 1	2	
Red Clover	64	16.000	0 to ½	1¼ to 1½	2	
Perennial Clover........	64	16.000	0 to ½	1¼ to 1½	2	
White Clover..........	65	32.000	0 to ¼	½ to ¾	1½	
Lucerne........	60	12.000				
Sainfain...............	26	10.280	¾ to 1	2 to 2¼	4¼	

This table, though a partial repetition of the table on page 33, will be found to contain some information which that does not, and that some which this does not.

In these experiments the soil used was under the immediate supervision of the gentlemen and, it is supposed, it was kept moist, so that an unusual number of the seeds

germinated. This would not be the case in the soil where, as the German adage has it—

> "One seed is sown for yourself,
> One seed sown for the Devil,
> One seed sown for the birds,
> And one for the stranger."

There will be, with the ordinary plan of sowing, a difference of depth of covering, some below the point of germination, some where only one-half come up, some on the surface, and these last are exposed to frosts, sun and birds. Besides, practically, it is impossible to get sound seeds throughout a whole purchase.

In one acre of ground there are 6,128,640 square inches. In the table given, it will be seen there are in a square foot of a rich old pasture 1,000 plants, or on an average, of about seven plants to the square inch. Now, to make due allowances for all the mishaps of seeds, it will be necessary to put on the ground not less than 60,000,000 seeds to secure seven plants to the square inch, for the number of square inches multiplied by seven, will make to the acre 43,908,480 plants. Some will say that if too many seeds are sown they will choke each other. That is precisely the case, and that is why it may not be feared to do so, for after all the choking is finished, enough are lift to cover the ground, and the object in view is obtained. Sinclair. one of the most trustworthy agricultural writers, says on the point of overseeding: "When an excess of grass seed is sown, the seed, in general, all vegetate; but the plants make but little, if any progress, until, from want of nourishment to the roots, and the confined space for the growth of foliage, a certain number decays and gives the requisite room to the proper number of plants; and that will be according as there are a greater or less variety of different species of grasses combined in the sward."

Such a mixture should be made in the sowings as if one species fail another will take hold. Nor is it proper to sow

the same quantities on the different soils of the State. On rich bottoms there will be a necessity for using a free hand, while on the sandy uplands we must withhold the quantity. It may be wished to pasture alternate years, or after the lapse of a few years altogether. All these reasons will modify the quantity of seeds to be sown. If a very early crop is wanted, such should be selected as come in early, or if a succession of crops be desired, it will be an easy matter to take from our list those that will ripen, or rather blossom, one after another to the latest, thus enabling the farmer to save all his hay in good time. This custom prevails to some extent in Ireland to sow the same quantity of seed to an acre of each kind as though no other sorts were to be sown, and enough of each kind to fully seed the land.

We do not desire to dictate to any one, but we append some lists that have been tried together and have succeeded, as well as some, that from our knowledge, will make good varieties for that purpose. Of course these lists can be varied according to one's own taste or experience.

FIRST—LIST OF SEEDS TO BE SOWN TOGETHER FOR MEADOW LANDS.

LAWSON'S MIXTURE.	For Hay.	For hay one year and pasture after.
	lbs.	lbs.
Herds Grass	3	3
Italian Rye Grass	6	6
Perennial Rye Grass	3	3
Orchard Grass	4	6
Timothy	11	9
Red Clover	8	4
Perennial Clover	......	2
White Clover	2	4
	37	37

SECOND—FLINT'S MIXTURE FOR SAME PURPOSE.	For Hay.	For hay one year and pasture after.
	lbs.	lbs.
Herds Grass	2	2
Italian Rye Grass	3	4
Perennial Rye Grass	3	3
Orchard Grass	6	8
Timothy	11	9
Rough Stalk Meadow	......	2
Meadow Fescue	2	3
Meadow Foxtail	......	2
Red Clover	8	4
Perennial Clover	......	2
White Clover	2	4
	37	43

THIRD—MIXTURE FOR ORCHARDS OR SHADED PLACES.	For hay one year and pasture after.
	lbs.
Orchard Grass	6
Hard Fescue	2
Tall Fescue	2
Italian Rye Grass	3
Perennial Rye Grass	3
Timothy	6
Herds Grass	3
Wood Meadow Grass	4
Rough Stalk Meadow Grass	2
Blue Grass	4
Perennial Red Clover	3
White Clover	4
	42

FOURTH—MIXTURE FOR LIGHT LANDS.	For hay one year and pasture after.
	lbs.
Orchard Grass	4
Blue Grass	3
Hard Fescue	3
Tall Oat Grass	3
Meadow—Soft Grass	3
Herds Grass	3
Italian Rye Grass	4
Red Fescue	2
Perennial Rye Grass	6
English Bent	2
Crested Dogs Tail	1
Perennial Red Clover	3
Black Medic	2
White Clover	4
Sainfain	2
	45

FIFTH—RECLAIMED OR SWAMP LANDS.	For Hay one year and pasture after.
	lbs.
Fiorin	2
Herds Grass	2
Hard Fescue	3
Meadow Foxtail	2
Meadow Fescue	2
Fowl Meadow	4
Italian Rye Grass	4
Perennial Rye Grass	5
Reed Canary Grass	4
Timothy	6
Rough Stalk Meadow Grass	3
Black Medic	2
Red Clover	4
White Clover	4
	47

Sixth—For Tennessee Bottom Lands.	For hay one year and pasture after.
	lbs.
Timothy	8
Herds Grass	3
Red Clover	6
Italian Rye Grass	4
Tall Oat Grass	4
Orchard Grass	5
Rough Stalk Meadow	4
Meadow Fescue	4
	38

Seventh—Swampy Lands Subject to Overflow.	For hay one year and pasture after.
	lbs.
English Bent	3
Tall Fescue	5
Slender Fescue	2
Canary Grass	3
Timothy	4
Herds Grass	3
Rough Stalk Meadow	4
Fowl Meadow Grass	6
Red Clover	6
	36

Eighth—Mixture for Rocky or Gravelly Hills.	For hay one year and pasture after.
	lbs.
Herds Grass	3
Tall Oat Grass	3
Crested Dogs Tail	3
Orchard Grass	3
Red Fescue	4
Meadow Soft Grass	2
Perennial Rye Grass	6
Timothy	6
Wood Meadow Grass	3
Blue Grass	2
Rough Stalk Meadow	2
Black Medic	3
Red Clover	8
	48

Ninth—Mixture for Dry Gravelly Lands.	For hay one year and pasture after.
	lbs.
Red Top	3
Sweet Scented Vernal	2
Tall Oat Grass	3
Sheep's Fescue	4
Red Fescue	4
Meadow Soft Grass	4
Creeping Soft Grass	4
Perennial Rye Grass	5
Blue Grass	4
Red Clover	5
	43

TENTH—MIXTURE FOR OLD WORN FIELDS.	For hay one year and pasture after
	lbs.
Means, or Egyptian Sugar Corn	5
Timothy	8
Rough Stalk Meadow Grass	5
Italian Rye Grass	4
Tall Red-Top	6
Orchard Grass	8
Red Clover	6
	42

ELEVENTH—MIXTURE FOR HAY AND TO RUN INTO PASTURE.	For hay one year and pasture after.
	lbs.
Orchard Grass	8
Herds Grass	6
Tall Oat Grass	3
Italian Rye Grass	4
Blue Grass	4
Red Clover	8
	34

TWELFTH—FOR WORN FIELDS WITH GULLIES.	For hay one year and pasture after.
	lbs.
Blue Grass	4
Orchard Grass	4
Gamma Grass	1 peck roots
Bermuda Grass	1 peck roots
Egyptian Sugar Corn or Means	½ bushel roots
Red Clover	8

These twelve mixtures, mostly adopted from Dr. Flint's work, with alterations to suit climate and soil will, as a rule, meet the demands of almost every variety of land in Tennessee. Of course any variation may be made in either the species or in the proportions, according to the fancy, bearing in mind the general amount of seed used in the above mixtures.

The first mixture, or Lawson's, is prepared for Scotland, and we were induced to engraft both that and the Nos. 2, 3, 4, 5, 8 and 9, which were arranged for a higher latitude, from the fact that much land in the State of Tennessee lies at so high an elevation that it is equivalent to a lower temperature. For instance, in East Tennessee, we find grasses on the higher mountains, that are only found on the crests of the White Mountains in New Hampshire. So, in descending the mountains, and even in the higher valleys, these grasses are in a flourishing condition, that will not grow at all, or very imperfectly, on the water courses of Middle Tennessee. In a visit to the Unaka Mountains, last September, in company with some members of the Association for the Advancement of Science we saw some grasses growing in great luxuriance on the "Balds" of that range, and on the top of the Roane Mountain that we had never seen elsewhere, but Prof. Chickering, of Washington City, recognized them as similar to those seen on Mt. Washington and in Canada.

There were *Poa annua,* the spear grass of Maine, but common on low lands in the State; *Agrostis perennans,* or Thin grass, a plant peculiar to marshy places; *Phleum alpinum, Carex juncea,* a rush-looking sedge, or rather a grass-like sedge; *Aira flexuosa,* or wood hair grass, an ornamental grass of the Northern latitudes; *Danthonia compressa,* or wild oat grass, and *Trisetum molle,* or downy persoon. Besides these were many others not determined by any of the botanists in the company. These grasses afford an immense pasturage during the summer to vast herds of cattle that are driven by the citizens for miles around to summer on them. Gen. Wilder, who owns a large section of land there, informed us the grass, when enclosed from the stock, grew to the hight of four feet. Very many varieties existed, all growing promiscuously together. This goes far to show the great difference of the development of the species in different localities, for at lower altitudes, with the exception of the Carex juncea these grasses grow quite low.

We think the lists given are sufficiently large to embrace almost every want of a grass grower in Tennessee. We direct special attention to No. 12 for use on some of the many worn out fields resulting from cotton culture. They stare at us on every side, and make an exceedingly unsightly appearance on a well ordered farm. The long creeping roots will swing down into the gullies and soon put a stop to washes, and the immense herbage will, after a while, renew the fertility of the soil. No. 10 is another mixture designed for the same purpose. It is only a matter of judgment to be exercised by the owner which he will take. No. 11 is a good mixture to use for hay, a few years, but the blue grass will ultimately master the others and will thrive on the fertility induced by the others. Nos. 1 and 2 are regular meadow grasses, amply proven by use in the New England States, and number 3 is better adapted for orchards or thin woodlands, especially lawns, too large to be devoted solely to ornamental purposes.

On light sandy soils number 4 would be a good selection, and would be well adapted to the Rim counties as well as to West Tennessee or that portion consisting of sandy soils. Number 5 would come in on any portion of the State where swampy lands that can be drained exist, and these lands are plentiful, both on uplands and bottoms. This character of land is exceedingly fertile when reclaimed from the coldness of water, abounding in all the elements necessary to produce largely most excellent grass. Nunber 6 is intended for those bottom lands not swampy, yet moist during most of the winter months. There is a great quantity of land on every creek and river in Tennessee lying on the flood plateau, and ordinarily the meadows are so injured by frequent overflows that the grass is either destroyed or greatly injured. Number 7 will meet the indications on these lands and survive any ordinary deposit of water. Numbers 8 and 9 are intended to be sown on the hill lands or mountain sides whose soil is full of gravel or rock. These are mostly creeping grasses, and will run over and hide large ledges of rock.

Clover is mixed with all the different numbers for the especial purposes stated heretofore, and we think even if it had no qualities as a hay grass, it should enter into every pasture for its great fertilizing qualities. In the first few, or New England groups, white clover is selected as one of the constituents. We might safely leave that out, as it is indigenous here and will spring up quickly on every pasture and meadow in "clover years," as they are termed, for some years it seems to disappear almost entirely, and then it covers the ground in the most unexpected manner every where. This is not the case in New England, and there it must be sown to get a stand.

These assumptions are not to be taken without verification by experiment, but are to be considered merely as the opinion of one farmer given to another, but a careful course of experiments could soon settle the question of the truth-

fulness of our opinion: Of one thing we are certain, and that is, that in following nature by a large admixture of species, we will get much quicker, and with but a small increased cost, a close firm turf or sward on both meadows and pastures. Some will say if we follow nature we ought to sow only those grasses that are natural to the soil. But it must be remembered that if this rule was observed we would deprive ourselves of the advantage of acquiring all those improved kinds found elsewhere. We would have no timothy or herds grass or blue grass, but only those kinds that may have been brought by winds or floods, or dropped by birds, and often seeds are brought in these ways that are not specially adapted to the soils where accident brings them. On the contrary, it should be the aim of every man to use his best endeavors to grasp that which is good, and improve that which he has. He should not hesitate to try everything that comes with a good character, and if he is deceived now and then, yet he sometimes gets a rich reward for his labor and expense.

TIMES AND MANNER OF SOWING.

Up to 1810 the almost invariable rule among all farmers was to sow grass seeds in the Spring of the year on crops of grain. Since that time the practice has changed to a great extent, and while some still adhere to Spring sowing, the great majority of farmers sow in the early fall. Some few sow grass alone, but the most of them sow with some kind of grain. There are many who contend it is much better to sow alone, as the half crop that will be harvested the next year is fully equivalent to the value of the grain crop, while if the two are sown together, they both work injuriously on each other. The stand of grass is injured, and the yield of grain is diminished. With all that, the general custom is to sow on grain fields, and wait until the second year for hay. Those who contend for the latter way, say, if the grass is sown alone it will be so delicate the first

year that the weeds will come up faster than it will, and destroy to a great extent the young grass; for at the time the mower should run over it to destroy the weeds, the farmer is so busy with the other crops, he neglects to attend to it, until the weeds have greatly injured the grass. But one thing is very essential, let it be sown with whatever it may, it must be in the ground long enough before frosts to take a deep root, or much of it will be destroyed by cold. Clover must, however, in either case, be reserved until Spring, as, when young, it is very sensitive to the effects of cold unless it is sown in August. It is the custom of some farmers to sow clover and other grass seeds, mixed in the last plowing of late corn. Should that course be decided on the corn must be late, and plowed on the level principle, and the clover sowed after the last plowing. Some crops have succeeded admirably, put in on this plan. But the better plan will be to prepare the ground well, as already stated, and sow the seed, if alone, from the 15th of September to the 15th of October; if with a grain crop as soon as it can be put in safely. Wheat is sown, as a general practice, too late to insure a stand of grass that will resist the winter, and it is therefore better to sow with rye or barley. Let the time of sowing be when it may, the farmer must watch for a season, otherwise the moisture brought up by plowing will be sufficient to germinate the seeds, but not to make them live, and even if the moisture is not enough to make them germinate, there may be enough to sprout them, and they will still be destroyed.

If it is the intention to sow on a stubble, it is better, as soon as possible after harvest, to prepare the land and sow in some of the August seasons, and if sown then the clover sowing may not be deferred, but sown with the other seeds, as they will have ample time then to root enough to withstand the cold of winter. Timothy, or herds grass, sown in September or October alone, will always make a good crop the next summer.

As compared with spring sowing, we may safely prefer fall. Both heat and cold are injurious to young grass plants, but of the two, cold is much less injurious than the droughts of summer. It was the experience of the writer, on one occasion, to sow a large meadow. He began about the 1st of September and sowed on until rains stopped him, and again in the middle of October, and finished early in March. On the September sowing there was a magnificent stand that stood over the ground with a solid turf. On the October crop the stand was fair, but much was destroyed during the winter, and the weeds were very troublesome the next year. On the March sowing the stand promised as well as the September crop, but the droughts of summer destroyed it completely.

But there will always be a difference of opinion on this subject, and this difference mainly arises from the difference in the character of soils. Some soils are better sown in the spring, while others secure better results by fall sowing—and in either case the successful farmer will advocate his plan. But in either case, as Gen. Harding truthfully says, a man will fail sometimes, let him sow when he will. No amount of prescience is sufficient to foresee all the casualties his labor is subject to, and for a man to give up or despair for one or two or even three failures, argues but poorly for his success as a farmer. He must continue to try, and when he succeeds he will have the proud satisfaction of knowing that he is master of the ground.

A few words only are necessary in regard to the manner of sowing. In the first place, the ground should be thoroughly prepared, and a season on hand, and if a rain has fallen since the ground was put in order, and packed the surface, run a sharp toothed harrow over it to break up the crust, then sow the seed and roll it in. A light harrowing will also do on clayey soils. If its surface is too rocky, stumpy or sloping, to admit a roller, the next best thing is to brush it with a light full brush.. If the surface is

perfectly smooth before the seeds are sown a light brushing does very well, but if it is not, a roller is preferable, as it will not cover so deeply as a brush. Remember that all seeds covered two inches deep will not germinate. If sown with grain, smooth the ground over with a brush after the grain is sown, and let a hand follow immediately behind and cast the seed into the brush. Never use a heavy thin brush, but if the limbs are full of twigs it will not matter as to weight. Then it will not cover too deeply.

It may be necessary, and generally is, to roll the land in the spring, especially if the meadow is a stiff clay soil, as the frosts of winter will usually heave up most of the soil, thereby carrying up roots and earth, and unless it is packed in again the succeeding droughts will surely destroy the grass. All these directions are not to be taken as applying to every locality, or situation, for as a differenee of soil and climate affects the results, so only can experience, controlled by reason, govern the complete details of this, or any other species of planting.

CUTTING, CURING AND STORING HAY.

There has been, and still is more differences of opinion among hay farmers, as to the proper time of cutting, than upon any other point connected with hay. There are different times for the different varieties, but as a rule there should be but one way. The time of flowering is, unquestionably, the general indication for the harvest to begin. At this time the saccharine juices that go to the formation and development of the seed, are stored in the stalk and leaves, and if saved then, they will loose only their watery constituents, and the grass will be as palatable and succulent as when standing, and will be eaten clean by all kinds of stock.

Still, some wait until the pollen falls and the seeds are in the milk, and those practising this plan contend that the hay will not scour the horses so badly, But there is another

reason why some defer the cutting to so late a date, and that is, it will not lose so much water, and consequently will be heavier and so bring more money.

A good authority says, "I cut in the blossom when the hay is designed for milch cows, or for fattening beeves, because in that state it makes more beef, and induces the cows to give more milk; but if for work stock, horses or oxen, I cut six days later, or thereabouts, because it does not scour or loosen the animal so much as when cut in the blossom." In either case, however, in an extensive crop, if the harvesting begins at the blossoming period, it will be six days before it is finished.

It is very evident if the hay is cut after the ripening of the seeds, the leaves will have but little sustenance, and the stems will be only woody fibre, the nutritive elements having nearly all gone to the seed. It is the testimony of most farmers that the rowen or the afterneath is better for milch cows, and for fattening purposes than the first cutting, which goes to prove that the earlier period, that is, at blossoming, is the best, from the fact that the season generally compels the farmer to cut the rowen before the grass is past the time of blossoming.

Another reason for not allowing the grass to mature the seed, is, that the meadow will sooner run out. When the seed forms, the vitality of the grass becomes impaired, and it falls a victim much easier to either excessive cold or heat. It is the disposition of all vegetation to die after it has made provision for perpetuation, and those grasses that have perennial roots are the exception to the rule, but all partake more or less of this principle. And besides it creates a heavier draft upon the soil than if cut sooner.

Some exceptions exist in regard to some of the meadow grasses in the list, as will be seen by referring to the table at the end of this chapter. This refers only to some of the coarser grasses, not in general use in Tennessee. For instance, if the "Means" grass is allowed to even blossom,

it is almost worthless. The Gamma grass and possibly the Lucerne should be cut as often as it is high enough to run the mower through them, as they become very hard, stiff and woody if they grow too rank, whereas, they are, if cut in time, very sweet and nutritious.

There is also much difference of opinion in regard to the proper time for cutting clover. Some will take a stalk and tie a knot in it, and if much sap exudes from it, they will leave it until it will barely show moisture. Others will cut when the field is about half in blossom, while still others will defer it until about half the heads are brown and the seed are in a milky state. But the mass of testimony is in favor of cutting clover when a few brown heads show themselves over the field. If the crop is exceptionally heavy, it is better to begin even before any brown heads appear. It seems strange that the clover will be heavier when cut green, but it is nevertheless true, and it is more relished by stock. Besides when cut early the leaves are not so liable to shatter as it is when dryer or later cut. And the leaves form no inconsiderable portion of this mass of clover hay.

It is a well known fact that just before the formation of the seed there is a larger per cent. of sugar, starch and gluten in the stalk than at any other time. When the grass first springs up it is filled almost entirely with water, as any one can satisfy himself by chewing a stem in its different periods of growth. As the plant grows and matures, the water gradually becomes impregnated with these substances, and at its blossoming period, these elements exist in their greatest quantity—in fact nature is now storing up material from which to form the seed, and these stores are held ready in the stalk, to effect that purpose. These elements are all soluble in water, and consequently, are easily dissolved by the juices of the stomach. But if these principles are allowed to go to the seed, they leave the stalk, and at once the plant starts on its downward course, becoming more and more woody, until finally decay sets in, and the hay is then

worthless; because the woody fibre is insoluble in the stomach. By reference to the table given at the close of this chapter of experiments on different grasses, it will be seen there are exceptions to this principle—some grasses giving more nutritive principles at seeding time, than others, while in blossom; but still, with this fact in view, if the grasses are allowed to go to seed, they impoverish the soil, lessen the age of the meadow, and utterly destroy the chance for a second crop—and the quantity of hay saved is almost always greater at any time before seeding than afterwards.

Prof. Kirtland draws the following conclusions from many careful observations as regards timothy:

1. "That timothy is a perennial plant, which renews itself by an annual formation of bulbs," or perhaps, more correctly speaking, tubers, in which the vitality of the plant is concentrated during the winter. These form in whatever locality the plant is selected without reference to dryness, or moisture. From these proceed the stalks that support the heads and leaves, and from the same source spread out the numerous fibres forming the true roots.

2. To insure a perfect development of tubers a certain amount of nutrition must be assimilated in the leaves and returned to the base of the plant, through the stalk.

3. As soon as the process of nutrition is completed, it becomes manifest by a state of desiccation or dryness, always commencing at a point directly above either the first or second joint of the stem near the crown of the tubers. From this point the desiccation gradually progresses upward, and the last portion of the stalk yielding its freshness is that adjoining the head. Coincident with the beginning of this process, is the full development of the seeds, and with its progress they mature. Its earliest appearance is evidence that both the tubers and seeds have received their requisite supplies of nutrition, and that neither the stalk nor the leaves are longer necessary to aid them in completing their maturity. A similar process occurs in the

onion just above the bulb, indicating a maturity of that organ.

4. If the stalk be cut from the tubers before this evidence of maturity appears, the necessary supplies of nutrition will be arrested, their proper growth will cease, and an effort will be made to repair the injury by sending out small lateral tubers, from which weak unhealthy stalks will proceed, at the expense of the original tubers. All will ultimately perish, either by the drought of autumn or the cold of winter.

5. The tubers, together with one or two of the lower joints of the stalk, remain fresh and green during the winter, if left to take their natural course; but if, by any means, this green portion be severed, at any season of the year, the result is the death of the plant." From these five propositions, the following conclusions are drawn:

1. "The timothy grass cannot, under any circumstances, be adapted for pasture, as the close nipping of horses and sheep is fatal to the tubers, which are also extensively destroyed by swine, if allowed to run in the pasture.

2. That the proper time for mowing timothy, is at any time after the process of desiccation has commenced on the stalk, as noted in the third proposition. It is not very essential whether it is performed a week earlier or later, provided it be postponed till that evidence of maturity has become manifested.

3. All attempts at close shaving the sward, should be avoided while using the scythe, and in guaging the mowing machines, care should be taken to run them so high that they will not cut the timothy below the second joint above the tuber."

Any one can verify these propositions and conclusions, by going late in the fall to a meadow of timothy and examining for himself. He will see that those tubers that have a green stalk, however short, will be large, full, healthy and and green, while on the contrary, those cut close will have

a withered appearance, and often will be dead. I have often seen tussocks perfectly dead, and until this idea was brought to my attention, was unable to account for it. There is also, it is proper to state, a small insect that is peculiar to timothy, and sometimes the death of the plant may properly be attributed to its ravages. The presence of the insect or its burrows in the bulb will enable the observer to attribute it to its proper cause.

CUTTING.

Perhaps no invention of agricultural machinery, and their name is legion, has afforded more positive benefit to the farmer than the introduction of the mowing machine. Before its invention, no farmer could, with certainty and success, secure a large amount of hay. It ripens in the hottest of the weather and at a time when the labor of the country is, as a general thing, all actively employed; so if a man did get enough, it was at an exorbitant price, fearfully reducing his profits. Then the grass, if of one crop, all needs cutting at once, so it would be impracticable to save it all in prime condition. The oldest instrument used, was a sickle, and for many years the farmer had to content himself with grasping with one hand what he cut with the other, and woe unto the back during this slow and painful operation. It was a great improvement on the sickle when the mowing blade or scythe came into use, though there were found then as now plenty of old men who adhered to the way of their fathers, and thought the scythe an innovation that would soon disappear. Though a great improvement, yet it is a most laborious operation, and a man that can cut down an acre a day is rarely to be found. It is a severe test of strength, and brings into play nearly every muscle of the body, so that there is no rest for any. But the mowing machine has rendered it unnecessary to use it, except in rocky or very broken spots, where the machine will not go. It is altogether unnecessary to adduce any arguments to prove the superiority of the mower over

the old plan. It will cut from six to eight acres in a day, and will spread the hay as it goes, better than a man will do it, and when cut by hand, it requires one man to every four or five hands to do the spreading alone.

Many persons object to the mowers, from the ease with which they are damaged. This can be obviated to a great extent, by buying in the first place, a well-constructed machine. No man may expect to get a cheap machine to do as good work or to keep up as long at it as one that has been faithfully constructed and carefully arranged. Then a farmer must himself be a careful manipulator. He must not expect to run his mower with impunity over roots, rocks or grubs. But if carefully handled and properly driven, there is no reason why one may not last through many years.

Another improvement is the horse rake. The first one used was the horizontal rake, that running under the swath heaped it up until the teeth were full, when by a slight lift of the handles, it turned over, leaving the hay in windrows. This it did very well, and still does well, but another has come into very general use, that is a little more extensive, but gives the driver a seat on it, and certainly gathers up the grass cleaner than the other. These are of various patents, and the selection is a matter of taste, all of them being good machines.

The Tedder is another machine that is used extensively in the Northern States, where the weather is more uncertain than here, and the hay dries much slower than beneath the Southern sun. It is seldom used in Tennessee, and is but seldom necessary. It is used for the purpose of shaking up and re-spreading the hay. Should a rain overtake the hay before it is put into cocks, it will be a very useful instrument to lift it from the ground and lay it down again lightly, thus allowing free circulation of air under it.

Being now supplied with the necessary machines to commence harvest, it is necessary, as a preliminary, to put

them in good condition, for the job. A carpenter would make but a poor progress, were he to commence a building without having sharp tools, so the mowing machine blades must not only be well ground, but they must be *kept* in that condition. When the blades become dull, their efficiency will be greatly impaired, leaving bunches of grass over the meadow, and adding greatly to the draught of the horses. Not only must they be well sharpened, but all the nuts should be tightened, as a loose bolt will often produce a breakage. Oil must literally flow upon all the rubbing surfaces. Many of the journals require to be oiled every fifteen or twenty minutes—good, pure oil should be used—that will not dry and gum up the works.

When starting in, select the longest "through," as the fewer turns the less loss of time. Keep an even, steady gait, as it will not be so apt to tire or fret the horses. Don't get fretted or out of temper if some slight delay occurs from carelessness, or accidents, but resolve to profit by the experience, and avoid like contingences in the future. There is a wonderful difference in the skill and effectiveness of different drivers. Some seem to glide over the ground without difficulty, all day with the grass falling as gently before them as if laid down by the touch of fairies, while others will storm, fret and frown all day with but little work done, and both horses and themselves be worn out at night.

We have refrained from going into a history or description of the various machines in use. They began at an early day, about 1830. Since the introduction of William Manning's, a great many different machines have come into use, and the very best evidence of the efficiency of all of them is that each man who owns one thinks that "make" the best. It is usual to have a mower and reaper combined, but when a man is farming on a sufficiently extensive scale, it is better to have them separate, for the motion necessary to be given to the sickle, in mowing, is too rapid in reaping, and consequently does not do so well.

Do not fail to have spare nuts, and especially spare sections for the blade, as the breaking of a section which will occasionally occur with the most careful management, greatly impedes the efficiency of the machine, and tires the horses with the harder pull it gives them.

It is unnecessary to say, that in beginning the harvest of the hay, it must not be commenced with threatning weather overhead, but rather await a good day, if the hay needs cutting ever so much, as it is better to have well-cured, over-ripe hay, than hay with all the sugar gum and gluten washed out by repeated rains.

CURING.

This is a point upon which there is as much difference of opinion, perhaps, as on any other point connected with harvesting. Some prefer to let it get dry on the ground, just as it is left by the mower, while others cure it in the wind-row, and still others cure it in the cock. This refers to the true grasses, for almost every one who makes hay of the clovers pursues one plan, which will be spoken of directly.

This difference in the plans of curing, results chiefly from the great difference there is in the curing quality of the various grasses. Timothy cures much easier and quicker than herds grass, while the coarser grasses, such as Gamma, Egyptian and others, require still longer time than herds grass. Formerly, it was the universal custom to allow it to lie until it was almost dry, before raking, but that custom is fast giving place to a more rapid method. Now, with many of our best farmers, it is deemed sufficient to allow it to remain on the ground after cutting a time, only long enough for it to become wilted, and then with a rake it is put into wind-rows. Hands follow immediately with hand rakes, or pitchforks and throw it up into cocks. Some do not even cock it, but, if the weather is favorable, allow it to remain in the wind-row for a day, or the second evening

after cutting, and then gather it up in wagons and carry to the rick or barn. But, probaby, the surest plan is to put it into cocks the evening after it is cut in the morning, and allow it to remain in this state for two or three days, according as the promise of good weather may be, then throw open the cocks and spread the hay before hauling up. It can be easily determined at this stage whether or not it is sufficiently cured. If, when examined, the cocks have become heated, by opening them out the heat that has been generated will readily become dissipated, and there is not much likelihood of its becoming again heated, One fact is well ascertained and that is, the sooner it goes into the rick or barn after cutting, without spoiling, the better will be the hay and the more will it be relished by stock.

It is much better to run some risk of barn heat, than to allow it to get a wetting. In the green state in which it is when cut, nearly all the nutritious properties of the grasses are in a soluble condition. To allow the rains to fall on the hay, will quickly dissolve them, and when washed out, the hay becomes almost worthless. A slight amount of heat is advantageous, as it is the result of fermentation, by which sugar is evolved and all its nourishing qualities become intensified, but if it proceeds too far, the hay becomes sour and is greatly injured. Some farmers adopt the plan of arresting its disposition to heat by sprinkling salt upon it, as it is stored. This is a good plan, and increases the fondness of stock for it if too much is not applied. One hand should apply the salt as it is thrown in, at the rate of about two quarts to the two-horse wagon load.

Should the farmer not wish to sell his hay, and is scarce of a supply, he can increase the quantity of provender by mixing, as it is put into the heap, a third or even a half of straw, or inferior hay, that has been left over, and in the curing process which takes place the juices of the new hay will penetrate and sweeten the straw, greatly improving its character, without deteriorating its own quality.

A most excellent farmer says, he waits until the dew is off, then starts his mower, and in the evening about 4 o'clock starts the rake, and has hands following with forks, and by the time the dew is falling, has it all in cocks. The next morning after the dews dry up, he opens and throws out the cocks, and immediately after dinner begins to haul to the barn.

When it is intended to let it remain in the cocks for several days, great care should be exercised in properly forming the hay into cocks in view of wet weather. We have no assurance of continued good weather, and should at all times be prepared for the worst. Cocks indifferently made would be, if possible, worse than if spread out, for the water would penetrate them all through and the hay would in a short time mould or rot. In the first place, they should be made large, not less than one hundred pounds in each at any time. Then make them as sharp at the top as possible, so as to be stout and secure against winds. Make the sides nearly perpendicular, and lastly, comb them down well from top to bottom with a pitchfork so as to throw as many stems as possible parallel with one other, thatching it out well in order the better to shed the water. But even with the most careful management, all the outer layer and some of the interior, will be destroyed by long continued rains.

Some farmers in the Northern States provide themselves with cloth caps. These will effectually protect the cocks from injury, and if properly cared for, will last many years. It is true in our warm climate they are not so much required as, with proper care, the entire crop can generally be saved without injury, but if any one should desire to allow the cocks to remain for several days in the field, it would be a matter of economy to provide themselves with caps. They are made of 5-4 duck, cut square, with a twine tied at each corner, and fastened to a peg. After the cock is made, a man follows with the caps, and fastens the pegs

in the ground at the four corners, pulling the cloth out as far as necessary to tighten the cover, so that it will stand over the hay like an umbrella. With these covers on, the cocks can bid defiance to the heaviest storms, as, although a little dampness would penetrate at first, they will soon swell and tighten, so as to be water proof.

In passing grass into hay and taking it into market, it is necessary to handle it quite frequently. The slovenly plan of some farmers to use forks made of a sapling, is to be greatly reprehended. Like all other trades, the use of good tools is essential to good farming, and no one should be without good three-pronged steel forks. It expedites work very much, and as a mere labor saving tool, is economical. Besides, it enables the hand to take and pass the grass more completely, leaving no gleanings behind. And then it greatly relieves the strain on the laborer. So do not, in this work, begin until good forks and hand rakes are provided. Sometimes the rake is very necessary, especially if from accident the hay gets beaten into the stubble by an unexpected thunder shower.

The farmers of the present day, enjoy an advantage unknown and unthought of by our forefathers. Heretofore we had weather prophets, men who would look wise, look all around at the clouds, and generally guess wrong as to continued fair weather. The moon was looked to as a harbinger of rain, and great stress laid upon the way it hung in the heavens when new moon began. There were, and are, many signs, portent and valuable, both to the mariner and farmer, and an observant person will often be able to see a storm in the mystic future. But all these signs pale into insignificance compared with the "probabilities" column of our daily papers. The chief of the signal office, stationed at Washington, receives from stations, all over the United States, information of coming storms, rains and winds, and by long experience, is able to tell almost with absolute accuracy the beginning of a wet spell, for at least twenty-four

four hours in advance, and can give a very good idea of it for two or three days beforehaud. In every daily postoffice in the United States a bulletin is posted, every morning, of these facts, so that it will not be difficult for those not seeing a paper, to become informed, through one or the other methods, and most farmers now base their time of harvesting on these predictions. The absolute necessity of getting a favorable time for this important work, will render the trouble and expense in procuring the necessary information, of small moment. The crop of the entire year, the health and comfort of all the stock on the place, depend upon the hay being properly saved, and a mistake or error on this point will entail a serious loss, one that will cost far more than the subscription to a good paper to say nothing of the useful information, to be derived from it besides.

The foregoing remarks apply to the true grasses only. With clovers and the leguminous plants it is different. Several plans will be detailed, each good, and the reader can then make his own selection.

Cut clover when the dew is off, let it wilt, and rake it into wind-rows. Allow it to remain in this state until the dew is off the next morning, and begin at once to haul and place in the barn, sprinkling salt in small quantities over every layer In this way the entire crop will be exposed only about 24 hours, which is amply sufficient for it. It will heat and go through a heavy sweat, but this will not injure it, and it will look as fresh and almost as green when cured, as when standing. The salt is essential to its proper preservation.

Another plan is to begin the formation of cocks on the evening of the first cutting, putting in all that was cut in the morning, and the next morning cocking what was cut the previous evening, thus giving each cutting twelve hours of sun. These grasses cannot take more sun than this without becoming so dry they will lose their leaves and blossoms A great risk is run by cocking clover unless the farmer is provided with cloth caps, as, from the crooked, tortuous

stems, it is impossible to shield the clover from the admission of water. The cocks are examined from day to day as the curing process advances, until the farmer is convinced, from his experience, the hay is well cured. Should no wet weather intervene the hay will be excellent, and will remain, uninfluenced by heat, in the barn an indefinite length of time. Some farmers provide themselves with split sticks, about the size of pea sticks, three feet long, driving them into the ground, three together, open at the bottom and close at top, in the shape of a tripod, and form the cocks upon them, thus giving them air in the interior. Heating is thus prevented, and the process of curing advances with much greater rapidity, and good hay is soon made. By this plan the hay will be well cured in two days at most, while by the other plan it will require three or four days. However, from the personal experience of the writer, which is considerable, the first plan detailed is the safest and best, and he has never failed to secure good bright nutritious hay. It would seem to many, that it would easily heat, mould and rot from the quantity of water in the stalks and foliage, but, there being a large percentage of sugar in it, it becomes candied and, after this, there is no difficulty in its keeping.

Should the farmer have a quantity of good clean wheat, oat, or rye straw, it is a very good practice, and a safe one, to throw a layer of it between each load of clover. It will permit the passage of the air and the aroma of the clover will penetrate the straw, each in this manner benefitting the other, so that both will be eaten with a relish by cattle.

For milch cows and sheep, clover hay, vetches, peas and beans are far superior to any other kinds of hay. Cows will yield more and better milk than from the other grasses, but for horses, the timothy and herds grass hays are superior to clover.

There are some other kinds of hay procured from the cereals, that must be treated in a different manner from

any of the preceding grasses, but this subject will be treated under the head of cereals, as soiling crops.

STORING.

But little need be said on this subject, as the practice of every one now is to provide, as far as practicable, for storage under shelter.

It was formerly deemed sufficient to stack the hay in the meadow, and enclose it with a pen, until wanted for use or sale.

Farmers often, instead of making conical stacks, put the entire crop into a long roof-shaped rick, In making either one or the other, care must be taken to carry it up with regularity, having no sink or depressions in it, as they would serve only to convey rains to the interior. The rake must be freely used on its sides to straighten out the stems and remove all loose hay that would otherwise be a waste. Of the two plans ricks are decidedly the better, as less surface is exposed to the rains, and consequently there is less loss. When it is desired to remove hay from a rick, it can be hewed from the end, either with an ordinary chopping axe, a broad axe, or with a regular hay knife, such being made and sold for the purpose. By this means, the roof of the rick will be intact, and the hay is not injured by exposure. On the other hand, in removing a stack it has to be attacked at the top of the cone, and unless it is all taken before it rains, the remainder is greatly injured.

But the stack and rick are both disappearing under the improved ideas of economic farming, and the hay shelter can now be seen on nearly every man's farm. It consists of tall shelters of beams and posts, without side-boarding. It is cheaply made, and is an invaluable aid to successful hay making. These shelters or barns are indispensable to hay made of clover, as it will not stand any amount of moisture,

however slight. The same may be said of several of the true grasses, and of all the leguminous plants.

Some, intending to feed all their hay, construct these shelters with a rack in the centre, and a set of joists about six feet from the ground, thus furnishing both food and shelter to the stock at the same time, and obviating the necessity of further handling.

Another plan of feeding, is to build a shelter with a sliding roof, or one that will rest on a large stack, and descend with the hay as it is eaten underneath, while the bottom is planked up around about five feet high, to prevent the stock from treading on the hay. But this is more expensive and does not afford any shelter to the cattle, like the sheds provided with central racks.

When it is not desired to have a number of sheds, and it is the intention of the farmer to soon dispose of his crop, it is customary to provide one shed, sufficiently large, in a convenient locality adjacent to the meadow, and stack all the hay just outside and around it, or near enough to be tossed under it to a hay press, and as soon as the crop is all secured the baling begins, and is continued until it is all stored in the form of bales beneath the shed, where it can safely await a favorable time for sale. Right here, let it be remembered that if a farmer wants a good price for his hay. it must be prepared with a view to sale from the beginning. It must be free of weeds, as no man, who purchases hay, wants to pay three or four cents a pound for worthless or noxious weeds, and however good these weeds may be, and there are some that are good feed, no man wants to pay hay prices for them. So should the meadow be infested with weeds, and they are cut with the hay, it will pay the farmer to have boys go over the windrows where they are all collected with the hay and pull them out. Of course they will not all be withdrawn, but many of them will be carried to the stack. In baling, it can be culled again and the greater part taken out, and should it not be done, it will enable the

purchaser to make a valid objection to really superior hay and get it at an inferior price on account of the weeds.

Then in making the bales, be sure to have a good powerful press. The heavier the bales, the less the cost of transportation and the smoother the look given the bale. Let it be neatly bound by either hoops, splits, or what is better, wire. The latter can be purchased at a cost but little higher than will be received for it again as weighed with the hay, and the bales will present a neater appearance than can possibly be given by the clumsier process of splits nailed to a board. This will of itself often decide a purchaser in favor of the sale. A buyer, going into a commission house to fill an order, will naturally be influenced by the neatness of the commodity to be purchased; and while he may not be a judge of the nutritious character of the hay, he will, as all merchants are, be a good judge of a merchantable bale. So it is seen with all branches of business connected with farming. A dairy that sends out nice yellow butter, will realize in the market, at all times, remunerative prices; while another, that puts on the market white puffy butter, will scarcely find a purchaser at a price great enough to save the producer from debt, although the cost of running the two dairies may be exactly equal. The merchant will be glad to sell for such a farmer, the hay will sell readily, and hence if there are profits he will be sure to realize them.

Having already spoken of various shelters for the protection of hay from weather, only one more will be mentioned, and that is the "SHELTERED STACK POLE," which is made in the following manner, viz.:

Set a pole six inches square on a cross of timbers about the same size, and brace it well from each beam of the cross. It can be put on either by a mortise and tennon or toe-nailed. Let the pole be about fifteen feet high, and have a series of 1½ inch holes bored every 12 or 18 inches, for about half its upper length. Have also a good stout wooden or an iron pin to go into these holes. Then make a

conical roof of some stout but very light material, cover it with half-inch sheeting, and let it be large enough to protect a space larger than the stack Frame it in such a manner that a square hole will be left in the top of the roof, through which the stack pole will pass. It will then slide to the bottom where it will rest, unless on hay. When it is wished to make the stack, raise the roof and confine it, by putting the pin through the pole underneath, and when the stack is completed let the roof drop on the top of the hay, and it will bid defiance to all manner of storms. Should it be necessary to move it, it can be readily carried on a wagon to any part of the farm and set up. Should it be the wish of the farmer to allow the cattle to feed on the hay in the stack, provide four batoned sides, like a door, say five feet wide, and in length the square of the circle made by the hay stack, provide them with stout hooks to fasten the corners. The stack is then protected to the height of five feet. In making the stack, lay rails or poles across the bottom on the cross timbers, and that will keep it off the ground.

TROUBLESOME PLANTS TO MEADOWS.

There are several plants exceedingly troublesome to the meadows in Tennessee. Among them is the White Top (*Erigeron Philadephicum*), or Fleabane. This is a perennial, and sometimes infests meadows to such an extent as to render them worthless. Meadows troubled with them should be mown several years in succession when the White Top begins to blossom. Broom Grass (*Andropogon Scoparius*) is also very pestiferous, destroying meadows after four or five years unless closely watched, and the broom grass cut up by the roots every spring. The Trumpet Creeper (*Bignonia radicans*) infests meadows in rich bottom lands, and when cut off by the mower, forms hard knots which will arrest the action of the sickle. This vine should be dug up "root and branch." White clover and blue grass are both

great enemies to the meadow, and when they prevail to any extent it is best to use the meadow as a pasture, and sow another meadow somewhere else.

A top dressing of superphosphate, or of stable manure every fall, after a crop of hay is taken off, will also do much to keep down noxious weeds and grasses. The farmer should always bear in mind that meadows require to be regularly fed. It is too much to expect that they will grow heavy crops of hay year after year, without exhausting the elements in the soil which go to make hay. These elements must be supplied. Restitution must be made if the farmer expects to have luxuriant and profitable meadows. The best rule to adopt is, never to take off a crop of hay without making a liberal application of manure.

The following is the table referred to in this chapter.

Table of the Comparative Product and Value of Grasses, as Experimented on at Woburn, by MR. GEORGE SINCLAIR, *under the direction of the* DUKE OF BEDFORD.

BOTANIC AND ENGLISH NAMES OF PERENNIAL GRASSES.	Height in wild state in inches.	Soil employed.	When weigh'd.	W'ht per acre when green.	W'ht per acre when dried.	Loss in drying.	64 dr'ms gave nutritive mat.	Nutritive mat. in one acre.	When in flower.	When in seed.	Proportionate value of the grass in flower to grass in seed.	GENERAL CHARACTER.
				lbs.	*lbs.*	*lbs.*	*d. qr*	*lbs.*			*Flw Sd.*	
Anthoxanthum odoratum*—Sweet-scented vernal grass..........	12	Sandy loam.	In flower.	7827	2103	5723	1 0	122	April 29	June 21	4 to 13	Early pasture grass †
			In seed.	6125	1837	4237	3 1	311				
			A. Math.	6806	....	....	2 1	239				
Holcus odoratus. Host.—Sweet-scented soft grass..........	14	Rich sand loam.	In flower.	9528	2411	7087	4 1	610	April 29	June 25	17 to 21	The most nutritive early grass†
			In seed.	27225	9528	17696	5 1	2233				
			A. Math.	17015	....	....	4 1	1129				
Alopecurus pratensis—Meadow fox-tail.......	24	Clay loam.	In flower.	20418	6125	14293	1 2	270	May 30	June 24	9 to 6	One of the best meadow grasses‡
			In seed.	12931	6819	7111	1 1	461				
			A. Math.	88167	....	....	2 0	255				
Poa pratensis *— Smooth-stalked meadow grass..........	18	Bog earth and clay.	In flower.	1[illegible]209	2871	7337	1 3	279	May 30	July 14	....	Good early hay grass‡
			In seed.	8507	3403	5104	1 2	199				
			A. Math.	4083	....	....	1 5	111				
Avena pubescens*—Downy oat grass..........	18	Rich sand loam.	In flower.	15654	5870	9783	1 2	366	June 15	July 8	6 to 8	Good pasture grass†
			In seed.	6806	1361	5445	2 0	212				
			A. Math.	6806	....	....	2 0	212				
Poa trivialis*—Roughish meadow grass.......	20	Manured light loam.	In flower.	7487	2246	5240	2 0	233	June 15	July 10	8 to 11	Good on rich moist soils†
			In seed.	7827	3522	4304	2 3	336				
			A. Math.	4764	....	....	3 0	223				
Agrostis stricta*—Upright bent grass..........	9	Bog soil.	In flower.	7486	2713	4772	1 2	446	July 28	Aug. 30	8 to 5	‡
			In seed.	4764	1310	3454	......	260				
				....	....	....	......	47				
Festuca rubra*—Purple fescue grass..........	12	Light sand.	In flower.	10209	3[illegible]57	6671	1 2	239	June 20	July 10	6 to 8	Good long grass
			In seed.	10890	4900	5989	1 0	340				
			A. Math.	30403	....	....	1 2	79				
Festuca ovina—Sheep's fescue grass..........	6	Light sand.	In flower.	....	....	....	......	....	June 24	July 10	....	Good long grass
			In seed.	6445	....	....	......	127				
			A. Math.	3408	....	....	......	66				

Dactylis glomerata*—Rough head cock's foot grass	24	Rich sand soil.	In flower. In seed. A. Math.	27906 26544 11910	11859 13272	16045 13272	2 3 1	2 2 2	1089 1451 281	June 24	July 14	5 to 7	A most productive grass but coarse†
Poa augustifolia—Narrow-leaved meadow grass	24	Brown loam.	In flower. In seed. A. Math.	18376 9528	7810 3811	10566 5717	5 5 ...	0 1 ...	1430 701	June 28	July 16	3 to 2	Excellent hay grass‡
Trifolium pratense—Red clover§	......	T. clay.	In seed.	49005	12251	3675	2	2	1914	July 18	Aug. 6	....	‡
Medicago sativa—Lucerne	36	Clay loam.	In seed.	70785	28314	4271	1	2	7659	July 18	Aug. 6	....	Best for soiling‡
Hedysarum onobrichis—Sainfoin	......	Clay loam.	In seed.	8848	35[illegible]9	52[illegible]8	2	2	345	July 18	Aug. 6	....	
Festuca duriuscula*—Hard fescue grass	12	Sandy loam.	In flower. In seed. A. Math.	18376 19075 10209	8269 8575	10116 10181	3 1 1	2 2 1	1004 446 199	July 1	July 20	14 to 6	Good for hay or pasture‡
Festuca pratensis—Meadow fescue grass	30	Bog soil.	In flower. In seed.	13612 19057	6465 7623	7046 11435	4 1	2 2	957 446	July 1	July 20	18 to 6	Excellent for early hay‡
Lolium perenne—Perennial rye grass	24	Rich brown loam.	In flower. In seed. A. Math.	7827 4492 3403	3222 4492	4494 10481	2 2 1	2 3 0	305 643 53	July 1	July 20	10 to 11	Generally esteemed†
Festuca loliacea—Spiked fescue grass.	36	Rich brown loam.	In flower. In seed. A. Math.	16335 10890 3403	7146 4492	9188 6397	3 3 1	0 1 1	765 553 166	July 1	July 28	13 to 12	Most valuable for hay and pasture‡
Avena elatior*Tall oat grass	50	Brown loam.	In seed. A. Math.	16335 13612	5717	10617	1 1	0 1	255 265	July 6	July 28	....	Good long grass†
Festuca elatior*—Tall fescue grass	36	Black rich loam.	In flower. In seed. A. Math.	51046 51046 15654	17866 17866	*33180 33180	5 3 4	0 0 0	3988 2392 978	June 28	July 16	20 io 12	Ex. mead. grass‡
Festuca fluitans*—Floating fescue grass	18	Stiff Clay.	In flower.	13612	4083	9528	1	3	372	July 14	Aug. 12	....	Aquatic grass
Holcus lanatus*—Meadow soft grass	24	Stiff Clay loam.	In flower. In seed.	19057 19057	6661 3811	12395 15246	4 2	0 3	1191 898	July 14	July 26	12 to 11	Early and productive‡
Poa fertilis—Fertile meadow grass	20	Clay loam.	In flower.	14973	7861	7111	4	2	1052	July 14	July 28	....	An early grass
Phleum pratense—Meadow cat's tail grass	24	Clay loam.	In flower. In seed. A. Math.	40837 40837 9528	17355 19397	23481 21439	2 5 2	2 3 0	1595 3669 297	July 16	July 30	10 to 23	Excellent for hay‡
Avena flavescens—Yellow oat grass	18	Clay loam.	In flower. In seed. A. Math.	8167 12251 4083	2558 4900	5308 7350	3 2 1	3 1 3	478 030 79	July 24	Aug. 15	15 to 9	Valuable grass‡
Agrostis vulgaris—Red top	18	Sandy soil.	In seed.	9528	4764	4764	1	2	251	July 24	Aug. 20	....	An early grass.

* Natives of the United States. † Best cut in seed, ‡ Best cut in flower. § A perennial.

CHAPTER XXI.

A WORD ABOUT MANURES.

The people of the South have much to learn in regard to the successful management of meadow lands. Many farmers seem to think it is possible to take large crops of hay from the same land, year after year, without adding any fertilizers. This is a grand mistake. One had just as well expect to check on his bank account day after day, without making additions to his deposits, as to check on the soil for large crops without properly feeding the land which grows them.

The question we ought to consider is, how to manage meadows after they are properly sown, and a stand of grass secured, so as not only to keep up their fertility, but to increase their power of production.

This question is so well understood by English farmers, that they seldom take a crop of hay from a piece of land without making a large and expensive application of manure. If the hay is cut several times a year, it is a heavy draft upon the soil, and some restitution must be made to the soil or it will soon cease to meet the expectations of the husbandman. The English farmer, enlightened by experience, in order to strengthen the land and stimulate the grass roots to renewed exertion, will draw out upon the meadow various kinds of manure to supply whatever wants he may deem the land requires.

There are not many kinds of manure in reach of a Tennessee farmer, unless he takes the forethought to provide them. But if he does take this in mind, and watches closely for every thing that will contribute to this end, he will be surprised, himself, at the result in a very short time. Besides those elements that are at the command of

every careful farmer, there is another class of manures called "artificial," and these can be procured at any place by a sufficient outlay. But they are costly, and it requires a scientific acquaintance with their properties, before the ordinary farmer will have the courage to invest in them. In other words, he must be able to see why and how his money will be returned with interest.

In order to properly understand the requirements of plants, it is essential the action of the different manures should be known, together with an approximate knowledge of the constituents of the soil. Soils are the result of the degradation, or breaking down, from various causes, of rocks. Through the great convulsions of nature, this triturated dust is mingled together, so that every species of rock formation is represented in every handful of clay. Were this not the case, we would have over limestone rocks a great mass of unproductive pulverized carbonate of lime; or over granite, we would see nothing but the sparkling atoms of quartz and mica, and over each stratum there would be the constituents of that rock, and hence no vegetation would charm the eye or delight the heart, to say nothing of our digestive wants. Through the agency of perfectly natural causes, (water principally), the soils have been intimately mingled. By this wise provision vegetation, in every spot in the world, finds some elements necessary to its existence. But it sometimes happens, that there is a deficiency of some of the elements, and again that there is a surplus. In the great alluvial swamps decayed vegetable matters exist to such an extent that some cereals do not thrive well, and on the other hand, on the steep mountain sides, by the action of washing rains, this matter has been carried off. Again, in many sections, the fertile matters have been exhausted, so nearly so, that the products of the soil cease to be remunerative. It is the province of scientific agriculture to point out these deficiencies and direct the remedy.

The soil originally consisted simply of the debris of the

rocks or clay. It is composed of the elements of the rocks, together with an intimate admixture of some mineral substances. In limited patches the soil partakes of the character of the formations underneath. Thus, in iron districts, the soil in places shows the presence, in considerable quantities, of iron, making the earth red or brown. In sandstone countries the clay has a quantity of sand overlying it, and among the primitive rocks scales of mica glisten on every side. The weight of a cubic foot of thoroughly dried soil averages as follows:

Siliceous sand	111.3	pounds.
Calcareous sand	113.6	"
Sandy clay	97.8	"
Loamy clay	88.8	"
Stiff clay	80.3	"
Slaty marl	112.	"
Fertile mould	68.7	"
Common arable soil	84.5	"

Chemists, from the earliest times, have been struck with the great proportion of insoluble to soluble substances in the soil. These insoluble substances will resist the action of acid and alkali in any quantities short of destroying vegetation. Analysts have strived by the aid of weak solutions of acids and alkilies to effect this, and though the science is by no means perfect, they have succeeded in rendering much inert matter, that has hitherto cumbered the land, into plant food. In an average of many kinds of soil the proportions are, of

Insoluble matters,	89.305;
Soluble matters,	2.047;
Phosphate, carbon and sulphate lime,	3.160.

Thus it is seen that, of the great mass of soil, ranging from a few inches to many hundred feet thick, only a very small per cent. is available to vegetation. Further, chemical analysis has also developed the fact that all animal tis-

sues are composed of these identical elements of the soil. Truly and literally, we are made of dust. But the animal kingdom does not derive its sustenance directly from the soil—that would be impossible. Our digestive organs are not constructed for that purpose, and could not assimilate such food, though in the great famine of Germany, in the 18th century, the starving millions did essay it only to die in torture. Nature has provided an intermediate agent, vegetation, whose organs are nicely adapted to this purpose. They send down into the soil their sensitive feelers, and pick up such stray bits of food as men or beasts require. They store it away in their granaries until it is called for, and these kind friends, are thus the purveyors to animal life. Not only is man thus directly fed by these natural agents, but, to keep up a constant unceasing supply, a large proportion is sent back to the soil, in a form to invigorate man's food. This refunded capital is variously called humin, ulmin, geine. Ulmin or ulmic acid, is the first formed; humin is formed from ulmin by the absorption of oxygen; geine or geic acid from humin by the further absorption of oxygen.

We will describe all these changes, however, under the gen-general term of geine. Under some form geine is essential to agriculture. It is the result of decaying vegetable matter, or in other words, it is the active principle of mould, and is the direct result of putrefaction. It is carbon, oxygen and hydrogen. It has a powerful affinity for nitrogen, one of the constituents of the atmosphere, and whenever it comes in contact, the hydrogen of the geine unites with the nitrogen of the air, and ammonia is the result. It also absorbs water freely, and this is why bottom lands, full of geine, fail to suffer from drought. The geine attracts moisture from the air and keeps the plant alive. These salts, humin, ulmin and geine, were formerly called extract of mould. They are, for the most part, soluble in water. For the sake of brevity, we will embrace all these salts as well as crenic and

and apocreic acids, convertible with the salts, under the general term *mould*. So far as nourishment is derived from the soil, this substance is the food of plants. It has been deposited over the clay, by the gradual decay of vegetation, through many ages, and according to the amount deposited, depends the value of the land.

Why it is that plants live and grow, or how they grow is a mystery no philosopher has ever been able to explain. God gives the vital principle, and so long as that continues the plant is able to resist an opposing power, which is chemistry. When life ceases, chemistry then asserts its power and decay begins, which leads to fermentation, and after this process is ended, putrefaction takes charge, which soon resolves the body into its original elements; and they are then ready to aid in the construction of another living body. Thus nothing is ever lost. It may change its location; the plant that grew at the head of a mountain torrent, may ultimately enter into the composition of a sugar cane in the delta of the Mississippi, but it is still in the universe, silently performing its duties.

What particular duties are performed by this geine or mould? It has the property, as already stated, of combining with nitrogen and forming ammonia. Ammonia is a powerful solvent of the inorganic elements of the soil, and by this action, fertility is generated. Alumina, magnesia, and various oxides of iron and manganese, will also unite with this geine, and the combination is to some extent insoluble, and thus stores of riches are, as it were, laid up for future use, and here it will remain an indefinite length of time. Under proper solvents or manures, they are again freed and ready for use. Suppose, however, none of these elements are in reach of the mould? Then the mould, dissolving in water in the form of a dark powder, filters down to the subsoil, where it lies until plowed up and brought into contact with air and water, when it regains its activity in dissolving, or rather uniting with the earth, and metallic

salts It is in this form known to chemists as *vegetable mould.*

We see, then, that the fertile elements do not consist entirely of mould, there must be some inorganic substances mixed with the mould to make a fertile soil. The inorganic substances, it may be proper to say, are the dust of rocks and metals.

Fertile soil, then, is composed of a combination of organic and inorganic matters. A clay bank, (inorganic matter), will grow nothing. A pile of rotton wood, (organic matter), will grow mosses, but no higher plants. Combine the two, however, in suitable proportions, and any kind of plant will spring up luxuriantly. Spread a heavy coat of stable manure on land and everything burns up; this is from the presence of a powerful alkali, (ammonia), that destroys vegetation by its acrid quality.

A neighbor thought he had a treasure house in a great heap of saw-dust left on his land by a mill. He poured wagon load after wagon load of it on his garden. What was the result? Such a mass of mould extracted large amounts of oxygen from the air, and acids were formed freely, making the land sour. Nothing would grow, and he lost the use of his garden for three or four years, and then it was good enough. Had he known it, lime spread over it would have sweetened the soil, and he would have had a garden, rich in vegetable mould, all the three or four years. So, it may be seen, the soil is a great laboratory, in which constant chemical changes are taking place Will we aid in those changes and hasten the result to our advantage, or wait the slow process of nature?

I have already alluded to the great benefit resulting from a union of theoretic and practical farming. In no branch of agriculture are the good effects better seen than when we begin to analyze the soil, and supply whatever deficiencies may be required. It will be interesting to know how the ele-

ments of soil act on each other, so as to become soluble, and, therefore, convertible into fertilizers.

The great component parts of soils are the silicates, (sands, quartz, etc.), salts, (as potash, soda, etc.), metallic oxides and vegetable mould. Silica exists in limestone rocks, in granite and in all sands. These silicates are slowly soluble, but elements of decay though slow are constant, and mountains have crumbled and been cast as huge, misshapened masses over the plains. By this action salts (soda, and potash) are freed and enter the soil, or are washed away into the ocean. It is in this manner that the ocean is made salty. But the sand is left, or rather the silex, and the soil is made more friable thereby. But suppose, instead of awaiting the action of nature, we introduce some of the earthy salts into the soil, lime, for instance. The lime acts directly on the silica, forming a silicate of lime that is soluble. Not only this, but the carbonic acid that is in the silica is freed, and this acts on other silicates, freeing their salts, and thus alumina is set free, the soil is impregnated with soda and potash, and instead of sand altogether, clay is formed. In this manner sandy soils are greatly improved by the addition of limes, either quicklime slacked, or land plaster, which is the sulphate. Some think this will impoverish the soil. So it will, if crops are raised on it, and so will crops impoverish any soil, but this store of mineral and earthy matters is useless if allowed to remain so, and, in its improved condition, nothing is taken out—it is only made available as plant food. Besides the supply is well nigh inexhaustible when we consider that less than two per cent. has supplied all the fertility to vegetation in all the past ages. It is not to be supposed a few pounds of these applications will make the great mass of soil fertile. By no means, for it would require well nigh the same amount of solvents as the matter to be dissolved. Still, it will enable the plants to get food where none existed before, that could be assimilated.

These free alkalies produced, as has just been stated, not only benefit plants directly, but they also act upon the mould, and will cause its decay. Or, more properly speaking, these alkaline earths will act on vegetable fibre, and change it into geine, which is synonymous with vegetable mould. But one strange thing is that this change in the soil is not apparent until a living body is applied. It is the great and mysterious effect of the vital principle, without which but few changes are noted.

Were all the matters soluble, and constantly in a condition to be washed out, the soil would soon, by the effects of water, be washed away and be deposited in the bed of the ocean. As it is, it is a great storehouse of food, that none unlock except those who have the "open sesame."

It is on this principle that plaster acts on clover. The plaster is, or should be, scattered on the plant while wet with dews. It adheres to it and is quickly absorbed into its vessels and carried to the roots where it, in the remote penetration of the rootlets, comes in contact with the elements of the soil. Through the action of the plant, the sulphur is separated from the lime, and then both are prepared to act promptly. The result is a wonderful stimulation to the clover, for a great store of food is at once placed at its command. In the same manner, common salt acts. There is certainly no manure in salt, no plant food, yet sprinkle a small quantity on plants, and by them it is decomposed, and the muriatic acid and soda act in dissociating other elements, and the result is great benefit to the plant.

If there were no salts nor mould in the soil, there would be no growth of plants. Mould is essential to plants, and without salts it is inert. So that when salts are active, mould is rendered active, and this will continue until one or the other is exhausted. Long before exhaustion takes place, however, the plants will languish and fail, so that the intelligent farmer must add, here a salt, there mould, and then by prudent management forever keep up his

fields to a high state of productiveness. There are reasons for all these assumptions, but space forbids their mention.

Many things contains salts available to the agriculturist. Lime, ashes, plaster of Paris, (sulphate of lime), saltpetre, common salt, phosphate of lime, bone dust, coal ashes, hair, hoofs, horns, copperas and many others. Some of these substances have to be used sparingly, such as salt or copperas, but all are beneficial to growing plants.

These substances act chemically, and free a great many inert matters. Growing plants absorb vast quantities of carbonic acid, through their leaves, and carrying it down, throw it into the soil, where it acts upon silica and allumina freeing salts for their growth.

Wood and coal ashes are very rich in the salts, and furnish one of the cheapest and best additions that can be made to land. Coal ashes are not so rich in the various salts, but contain enough to merit a better fate than is generally awarded them.

The composition of wood ashes is as follows:

200 parts of unleached wood ashes contain,

Carbonic acid,	58.53
Sulphuric acid,	6.43
Phosphoric acid,	3.40
Muriatic acid,	1.82
Lime,	50.35
Magnesia,	4.55
Potash and soda,	67.96
Silex,	5.22
Oxide iron,	.50
Oxide Manganese,	1.10
Water,	.14
	200.00

Of this 27.14 parts are soluble at once in water, and leached ashes are deprived of it, and the balance, 172.86 parts are insoluble, but act slowly on the soil freeing various

substances in the process of time. Coal ashes contain these same ingredients in a much less degree, or if soil is entirely deprived of its vegetable mould, it is identical almost with coal ashes. Each hundred pounds contain eight pounds that are at once valuable to the farmer, and another portion has a prospective value. Coal ashes are worth a good deal, simply as a mechanical loosener of the soil. Mixed with it, in even small proportions, it renders the soil friable and easily worked.

Having now explained that there is a principle called mould or geine, and that this principle is necessary to fertility, and also, that this principle to be in an available form, must be reacted on by salts, it remains to inquire the best form in which these elements are united. Practically, every farmer in the country will at once answer stable manure. And, as is generally the case, practice has long found out what science seeks a reason for. A careful analysis of cow manure, which is generally accepted as the unit of value, shows that cow dung consists, not to go into an ultimate analysis, of

Water,	83.60
Salts,	0.95
Geine,	15.45

This seems to be a small proportion of valuable matter, only one-sixth of the whole amount. But let us see what a careful farmer can do by saving for a year. In an experiment, conducted carefully and published a few years ago, an average cow was selected, and everything she ate or drank was carefully weighed, as well as all the voidings of dung. This experiment lasted seven days, and from a calculation, this cow would have made in one year, 4,800 pounds geine, 71 pounds bone dust, 37 pounds plaster, 37 pounds lime, 25 pounds common salt, 15 pounds sulphate potash.

This, carefully saved, furnishes salts of lime equal to four and a half bushels of corn daily, or 1,662½ annually. Not

only is this amount saved, but in addition the nitrogen that is in it, by chemical affinity, creates a large amount of ammonia, that is fixed and amounts in a year to 677 pounds. To the nitrogen is due much of the excellence of this stimulant, and without the animal matter or nitrogen, it would be nothing more than decayed wood and salts. It is a common idea that the activity of stable manure is due entirely to the animal excrements. It is due rather to the happy combination of ammonia, geine and salts, such as no chemist can manufacture from the food of the cow. Were this possible, a pile of rotted hay and turnips would supply all these united elements. But effort has demonstrated that it cannot be done. Nor does the food of a cow affect, but little, the elements of dung. A cow fed on rich nitrogenous food, such as corn or oats, will give some more nitrogen in the dung, and form more ammonia, but the salts and geine will be but little changed.

Horse dung is much richer in manures than cow dung. But horse dung very quickly ferments, and, by fermentation, it will lose one-third its value in one month. It is therefore very necessary to remove, as often as possible, the horse dung from the stable, and place it in the compost heap, with the cattle dung, or with alternate layers of soil and sprinkled with lime or plaster. These salts will catch and fix the escaping ammonia and prevent much loss. After horse dung has fermented, if alone, it is of far less value than cow dung, but before it ferments, it is much more valuable. When that process is completed fully, nine-tenths of its value, according to our best writers, is lost. These are statements based on, not only experience and observation, but also on absolute chemical analysis. How much it stands the farmer in hand then to observe a systematic saving and storing of these treasures of agricultural wealth! A compost heap, under a good shelter, is to the uninformed, a heap, reeking with filth, repulsive to the eye and offensive to the olfactories. But, to the scientific far-

mer, it is a bed of power. In it are contained the yellow grain and the luscious fruit; over it hovers the spirit of the rose and the lily, and sweet odors are stored in it, to make the fragrant pink and the delicious heliotrope. Let every consideration of economy and enterprise, stimulate the farmer, then, to save every waste of the farm. The Chinese are so sensible of the importance of manure, in a country teeming with an over-population, where the soil is tasked to its utmost to carry its population, they even save the parings of their finger and toe nails to add to its fertility. The farmer has a wonderful bank to draw upon for this purpose. Cattle and horse dung and urine, the scrapings of the barn-yard after every rain, straw, stalks, leaves of the forest, drifts on the banks of streams, all contribute their share in the general enrichment of the farm. And any one would be surprised at the amount accumulated for the spring scattering, if systematically carried on for one year. It requires but a little time too, if a regular time be given to it. Regularity and system are the great watchwards of improvement.

Millions of dollars are annually wasted, by burning straw and stalks, which, if carried to the stables and barn-yard, would act as solvents, to catch this daily waste. If the ashes, resulting from the burning straw, were as good manure as the straw itself, then burning would not be wasteful. But a large amount of valuable matter goes into the air as gases, besides much is blown away by the winds. A Mr. Lawes, of England, determined this matter of burning manure in an experiment, that was both fair and positive. He took 28 tons of yard manure and divided it; 14 tons were reduced by fire, leaving 32 cwt. of ashes. He then scattered the 14 tons of manure left, on one acre of land, and the 32 cwt. of ashes on another acre of land, and left another acre without any application. He cultivated them all well and alike.

The manured acre made 22 bushels of wheat, the ashed

acre, made 16, and the unmanured acre made 16 bushels. This proves that the more nitrogen manure contains in combination with the salts, the more value it has.

Night soil, or the excrement of human beings, is next to chicken manure, the richest and most stimulating of all manures. Then come that of fattening hogs and sheep, horses and cows. But, as before stated, the disposition to waste is so great, that the "cold" manures, as that of cows, sheep and hogs, are more available to the farmer than the more active ones of man and horse. The analysis of the different manures are given in the table below. This table and the three following, are taken from American Manures by Dr. Bruckner.

	Water.	Phosphoric acid.	Potash.	Nitrogen.	Ammonia.
Pig Dung	840 lbs.	8.0 lbs	5.0 lbs.	7 0 lbs	8.5 lbs.
Horse "........	743 "	12.2 "	28.0 "	5.4 "	6.5 "
Cow ".........	864 "	5.2 "	10.7 "	3.5 "	4.2 "
Chicken ".........	850 "	15.2 "	5.5 "	21.5 "	26.1 "
Sheep ".........	670 "	22.7 "	7.0 "	7.1 "	8.5 "
Human ".........	750 "	3.3 "	1.0 "	15.0 "	18 2 "

The following table shows about the amount produced annually by a single animal of the kind named, and its value, assuming the phosphoric acid to be soluble, and the nitrogen as actual ammonia.

	Amount.	Phosphoric acid.	Potash.	Ammonia	Value.
Pig.........	200 lbs	1.6 lbs.	1.0 lbs.	1.7 lbs.	$0.6[illegible]
Horse......	2,000 "	24.4 "	56.0 "	13.0 "	9.94
Cow.......	2,000 "	10.4 "	21 0 "	8.5 "	5.15
Chicken....	5 "	0.076 "	0.03 "	0.13 "	04
Sheep......	50 "	1.27 "	0.35 "	0.42 "	.40
Human	100 "	0.33 "	0.10 "	1.80 "	.50

We now give the value of the urine of different animals, as shown by the fertilizing salts contained in 1,000 pounds of each:

	Water.	Phosphoric acid.	Potash	Nitrogen.	Ammonia.
Pig Urine......	9.29 lbs.	trace	6.0 lbs.	11.8 lbs.	14.3 lbs.
Horse "......	9.40 "	trace.	2.8 "	15.4 "	18.7 "
Cow "......	9.23 "	trace,	4.5 "	4.4 "	5.3 "
Sheep ".....	9.65 "	1.3 lbs.	7.2 "	13.1 "	15.9 "
Human "	9.57 "	4.0 "	2.0 "	14.2 "	17.2 "

The following table shows the amount produced annually by a single animal of the kind named, and its value as manure, when fermented:

	Yearly amount.	Phosphoric acid.	Potash	Ammonia.	Value.
Pig Urine......	1,000 lbs.	trace,	6.0 lbs.	14.3 lbs.	$4.00
Horse ".....	2 000 "	trace,	5.0 "	37.4 "	9.79
Cow ".....	2,000 "	trace,	9.0 "	8.8 "	2.92
Sheep ".....	500 "	0.6 lbs.	3.6 "	8.0 "	2.35
Human ".....	750 "	3.0 "	1.5 "	10.7 "	3.16

Says Dr. Bruckner: "The sold and liquid excretions taken together, will show the following annual value:

Pig excrements,	solid	and liquid	....	$ 4.62
Horse	"	"	....	19.73
Cow	"	"	....	8.07
Sheep	"	"	....	2.75
Human	"	"	....	3.66

From these tables, it is plain that too much care cannot be exercised in preserving the excrements of man and animals. Every pound of ammonia that is lost or evaporates, represents the amount required for a bushel of corn; and every pound of the urine of a horse or man, will furnish sufficient ammonia for a pound of wheat; and two and a half pounds of the urine of man will furnish the phosphoric acid, and more than half of the potash required for a pound of wheat."

It then remains for us to make the application of these remarks, and every right-thinking man will see at once the importance of gathering up and saving. It is money in his pocket. One man will burn a few bushels of soil, and setting it near the privy, will throw, every day, a few hands-

ful on the pile of excrement, and in a few months he will fill his barrels with the most valuable pondrette, that another man will go to the city and pay a large price for. One man will set a few barrels of ashes in a convenient place, and cause the house-cleaner to empty the urine of the night into them. In a few months he will have his ashes thoroughly saturated with salts, and organic matter the most valuable.

In England, farmers do not consider it any hardship to dig cisterns, in which to save all the liquid excrements of the cows and horses, and with a water cart, spread it over their pastures and meadows.

Many object to the use of human excrement, on account of its offensiveness. This can be easily prevented, and at the same time by an agent that is a valuable addition to the manure heap. The sulphate of iron (copperas), is a powerful deodoriser, and a few cents worth added to the night soil will deprive it of any offensive smell for a length of time, sufficiently long to remove it.

A great many bones are wasted on every farm that make valuable manure, and are easily prepared for use. Let a barrel be devoted to bones, and whenever a bone is thrown into it, cover it up with unleached ashes. Let the barrel stand in the weather and in a few months the bones will be so friable they may be easily broken and converted into an unadulterated bone dust, better than can be bought in any of the agricultural stores. Or if he cannot wait this slow process, they are easily burned and crushed.

In making soap, much fine phosphate of lime is thrown out in the shape of half eaten bones and in spent lye. Soap suds are also a fine addition to the manure or compost heap. In these are found, not only the alkalis of soda and potash, but also much nitrogenous matter in the shape of grease. All these assist in enriching our heap.

No farm yard is without the best guano. It is true, the guano of the shops is from sea birds, whose food is fish, but

the guano of the chicken house is exceedingly valuable and well worth saving. Mixing it with soil or ashes and sowing it over a garden plat, rather thinly, for it is very rich, its effects are seen to the row. However, the dung of fowls and especially of pigeons is best applied in the form of solution. It is not so apt to burn up the plant in this manner. One part of manure to ten parts of water will make a fine wash for vines, or for fruit trees it is unexcelled. Another addition to the heap is skins, carrion either of animals or fowls, scales of fishes, hair, hoofs, and in fact every kind of animal substance that may come within reach that is worthless. Instead of dragging off dead horses or cows, as an attraction for buzzards and dogs, cut them up and let them add to the manure heap. In this way a valuable addition will be made.

Among the richest of all manures, not excepting animal matters even, is soot. It is not only rich in salts, but in geine. It is said there are as much salts in 100 lbs of soot, as there are in one ton of cow dung. Nothing is better for vegetables, than an application of water with soot dissolved in it. Besides, bugs are not fond of it, and it drives them away. Throw all the soot of the chimneys, by all means, on the heap.

Sheep dung is one of our finest manures, and what is better, the animals do the spreading themselves. A worn-out meadow or pasture if given to sheep, and they are kept in it any length of time, will be restored to its pristine fertility. It is said that 1000 sheep run on a piece of ground one year will make the soil capable of yielding grain enough, over and above the capacity of the soil without the sheep manure, to support 1035 sheep an entire year. Unless the sheep are nightly folded, however, the manure cannot be gathered. If it can be collected, put it on the pile, by all means.

We have now enumerated the principal sources whence a farmer can draw his supplies without drawing upon his

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pocket. Many kinds, under our system of farming, are unavailable to the farmer. I mean the liquids. Without floors to the stables and pig-pens, the urine, which is the richest of manures, so far as salts are concerned, is wasted. But he can save his own, and the excrements of one man, properly saved for one year, will well manure one acre of land. Why let these rivers of wealth flow away from the farm? He prefers going to the shops and buying worse than he can prepare on his farm.

There are many artificial manures for sale. Plasters from Kentucky and Virginia; phosphate of lime from South Carolina; bone dust from the large cities, and many other mixtures and compounds. But scarcely a farmer but what has at his command a manure, rich in every respect and with the addition of a cheap alkali, equal in chemical properties to cow dung: I mean the scrapings of ponds, and the mud of rivers and creeks. West Tennessee has an area containing pure muck, the balance of the State has no such advantage; but next to muck, and nearly as valuable, is pond and river mud. By the addition of two pounds of sal soda or potash, such as is used for washing purposes, to 100 lbs of muck, the mass becomes, as near as possible, cow dung. So, here we have an almost inexhaustible supply of cow dung, without its smell or offensiveness. The green sand beds in West Tennessee also will supply fertilizers in unlimited quantities.

Here then, the provident farmer has all that is requisite to enrich his grounds before seeding to grass. It is needless to say that clover, as a preceding crop to land that is about to enter the long and tedious travail of meadow, is absolutely requisite. But after it is started, the farmer need not think, for one moment, that grass adds to its fertility. It does not, but on the other hand, detracts just what the farmer cuts off; and if he is a wise farmer, he will put it back in a shape to increase his drafts on it.

When a meadow or pasture becomes packed, from too

much pasturage, it will be well enough to run a subsoil through it occasionally. This loosens the under sod, and the narrow helve does not tear up the turf. Of course the land has been, if required, well drained. In addition to this, for the renovation of such lands, the application of manures is indispensable. It should be applied immediately after a cutting, as it will stimulate the roots, made weak by being deprived of their foliage, to renewed growth, and prevent much of it from dying. Of course it must be done by top dressing, and by far the most efficaceous plan is to apply it in the liquid form. It may be done by diluting the manure with from five to ten parts of water, and using a cart, such as is used for sprinkling streets. Another, and the most common way, is to drive through the meadow with a load of good compost; such as we have described, and with two hands in the rear of the wagon with shovels, it can be scattered broadcast as fast as the team will walk.

A few years ago, a machine for scattering manure was invented, by John W. York, of Williamson County, and if that machine could be sold at a reasonable price, it would save the most tiresome labor of the farm. It should by all means be so simplified as to reduce the expense, and place it within the reach of every farmer. With such a machine, scattering or drilling manure would be a work of no more labor than drawing up a load of wood, not as much.

Pastures treated to a top-dressing after every cutting, could, like the English pastures, instead of three acres to the ox, feed three oxen to one acre, and the meadows would not yield a scanty ton to the acre, but we could continue to cut until stopped by cold weather. An English tenant will pay ten pounds ($50) rent per acre for meadows, and will get always two, frequently three, crops per year, yielding from three to five tons per acre. We could do this also by following the same system of farming, and that is, to run the manure wagon constantly.

The following Table arranged by Ezra E. Adams, of the N. H. Agricultural College, will show the amount of water, organic matter, nitrogen, and mineral ingredients in given quantities of natural and manufactured fertilizers.

				Principal Ash Ingr'nts.					
In 1,000 Pounds of	Of water.	Of organic matter.	Of nitrogen in organic matter.	Of Potash.	Of soda.	Of lime.	Of magnesia.	Of phos'ic acid.	Of sulph'ic acid.
Animal excre'nt, fresh are	710	246	4.5	5.2	1.5	5.7	1.4	2.4	1 2
" excrement rotted "	790	145	5.8	5.0	1.3	8.8	1.8	3.0	1·3
Dung-heap liquid.... "	982	7	1.5	4.9	1.0	0.3	.4	.1	.7
Fæces fresh......... "	772	198	10.0	2.5	1.6	6.2	3 6	10.9	.8
Human urine........ "	963	24	6 0	2.0	4.6	.2	.4	1.7	.4
Night soil, fresh..... "	933	51	7.0	2.1	3.8	.9	.6	2.6	.5
In 100 Pounds of									
Peruvian guano.....are	14.8	51.4	13.0	2.3	1.4	11.0	1.2	13.0	1 0
Dried Blood........ "	14.0	79.0	11.7	.7	.6	.7	.1	1.0	.4
Bone meal, av....... "	6.0	33.3	3 8	.2	.3	31.3	1.0	23.2	·1
Bone black, fresh.... "	6.0	10.0	1.0	.1	.3	43.0	1.1	32 0	.4
Baker guano........ "	10.0	9.2	....	.3	.6	46.0	1 2	35.4	.4
super-phosphate. "	15.0	6.2	.3	....	.1	25.9	.9	21.8	28.5
Navassa phosphate.. "	2.6	5.4	.1	....	....	37.5	.6	33.2	.5
super-phosphate. "	15.0	2.5	....	....	....	17.0	.3	15.4	19.5
Rectified P. guano... "	16·0	41-9	10.0	2 0	1.2	9.5	1.0	10.5	15.0
Sal. ammonia....... "	4.0	....	20.0	....	....	.5	....	....	58.0
Nitrate Soda........ "	2.6	....	15.5	....	35.0	.2	....	....	.7
Plaster............. "	20.0	....	....	....	....	31.0	.1	....	44.0
Gas lime............ "	7.0	1.3	.4	.2	....	64.5	1.5	....	12.5
Ashes, av........... "	5.0	5.0	....	8.0	2.3	32.5	5.5	5.5	1.6
Leached ashes....... "	20.0	5.0	....	2.5	1.3	24.5	2.5	6.0	.3
Coal ashes.......... "	5.0	5.0	....	.1	.1	....	3.0	.1	5.0

Silica and small amounts of other ingredients not named.

This Table indicates the various elements of plant food removed from the soil by crops, as given by Prof. Atwater, in Connecticut Report.

Crops and Amount.	Lbs. and Decimals of					
	Sulph'ic acid.	Phos'ic acid.	Lime.	Magnesia.	Potash.	Nitrogen.
Rye.						
Grain, 25 bushels—1,400 lbs.	.3	11 8	.7	2.9	7.8	24.6
Straw, 3,500 lbs.	3.8	7.3	12.2	3.9	27.3	14.0
Total by whole crop	4.1	19·1	12.9	6.8	35.1	38.6
Oats.						
Grain, 30 bushels—960 lbs.	.4	6.0	1.0	1.8	4.2	18.4
Straw, 2,000 lbs.	2.6	3.8	7.2	3.2	17.8	11.2
Total by whole crop	3.0	9.8	8.2	5.0	22.0	29.6
Wheat.						
Grain, 20 bushels—1,200 lbs.	.1	9.5	.7	2.4	6 4	25 0
Straw, 3,000 lbs.	3.3	6 6	8.1	3.3	18.9	14.4
Total by whole crop	3.4	16.1	8.8	5.7	25 3	39.4
Corn.						
Grain, 50 bushels—2,800 lbs.	.6	16.5	.8	5.6	10.4	44.8
Stalks, 6,500 lbs.	7.8	34.5	26.0	16.9	62.4	31.2
Total by whole crop	8.4	51.0	26.8	22.5	72.8	76.0
Hay.						
Mixed grasses, 1½ tons—3,000 lbs.	7.2	12.3	25.8	9.9	39.6	46.5
Potatoes.						
Tubers, 150 bushels—9,000 lbs.	5.4	14.4	1.8	3.6	51.3	30.6

THE CEREALS.

PART VI.

Though this work is intended to be a treaties, especially on grasses, yet, from the structure and conformation of their parts, the cereals are, botanically speaking, included in the list.

In a work of this kind, intended as a hand-book for the farmer, the description of these cereals would come properly before them, as useful additions only to such knowledge as they already possess, and, though the experience of every man in the State may embrace the cultivation of cereals, yet there are some whose knowledge has not yet extended to the history, cultivation and care of all of them. Besides, there are always many beginners in the noble science of agriculture who, in the ordinary course of farming, learn some things by observation but mostly by experience—sometimes disastrous enough to dishearten some,.deter others. Experience is always a costly teacher and is a work of years. To such this part is commended, hoping they may be helped over those difficulties by which so many have become wrecked. It is not proposed the rules here laid down should take precedence over the approved plans of any one, but he may add the hints here given, to such experimental knowledge he already possesses, and thus make farming a success, founded upon the combined facts of

many here given, with such principles as have already been established by his own deductions.

Scientific or theoretic farming has been brought into disrepute too by the efforts of amateur farmers with no practical experience, which generally end in failures. Science will teach many things of vital importance to the farmer, but, if applied improperly, it can effect no good result. In agriculture little, and seemingly unimportant discoveries are valuable. Nothing is to be dispised which may lead to a rational and true theory of agriculture; this can only lead to successful practice. Practice, founded on sound principles, can be taught only by a knowledge of the manner in which the elements of soil affect each other and vegetation. This knowledge cannot be obtained without the application of theoretic opinions. The opinions of merely scientific men may be wholly theoretical; but, what is science?

Sir Humphrey Davy says, "Refined common sense, the substitution of rational practice for unsound prejudice."

In no department of human industry is there so great a demand for the union of theory and practice as in agriculture. The book farmer and the practical farmer must now shake hands. They must harmonize their differences and cease taunting each other. They have been too long wrestling and trying to get each other down, at arms' length, but in the close embrace necessary for a throw they find they can stand longer. So it should be; theory and practice should and do mutually support each other.

The theoretic farmer and the practical farmer aim at one object. The latter is employing certain means to affect certain ends; the former unfolding the laws of nature which limit and control the operations which are performed to effect that end. Theory may teach a rational and successful practice; this last may lead to a rational theory. But without a knowledge of the laws of nature, and the action of certain elements of the soil which can only be obtained by study, the practical application of science to agriculture is but the delirous dream of fanatical enthusiasts.

The different cereals will now be taken up in the order in which they are named. The cereals, we may premise, are all annuals; that is, they grow and mature their seeds in one season, and then die; and, to perpetuate them, they must be planted once every year.

1. Barley.
2. Broomcorn.
3. Buckwheat.
4. Dhouro corn.
5. Maize, or Indian corn.
6. Oats.
7. Rice.
8. Rye.
9. Sorghum, or Sugar Cane.

Wheat, the chief of cereals, is excluded from this list, as a monograph has already been issued from this office devoted exclusively to wheat, to which the reader is respectfully referred.

CHAPTER XXI.

BARLEY—BROOMCORN.

COMMON BARLEY--(*Hordeum vulgare.*)

An annual, with hollow stems, about three feet high; glumes six, at each joint, in front of the three spikelets, forming an involucre at the zigzag points of the rachis; spikes dense, the three spikelets at each end of the rachis all with a fertile flower; flowers six in each involucre; lower pale with very long awn. Flowers in May.

Hordeum Vulgare.

Barley has a longer and more slender seed than wheat, set in rougher, stronger chaff, and has a very much longer awn or beard. Anciently a barley-corn formed a standard of measurement, the average length of one being .345 of an inch. The weight is fifty pounds to the bushel.

There are four varieties of barley, viz: *Hordeum vulgare* or Spring Barley, *Hordeum distichum* or Two-Rowed Barley, *Hordeum hexastichum*, or Six-Rowed Bar-

and *Hordeum zeocriton*, the sprat or battledore barley. The first named is used generally throughout the North, and is sown in the spring, while in the South it is sown in the autumn.

The grain of the six-rowed variety is much smaller than the others; but the yieid is larger. When the grain is deprived of its husk by a mill it is called *pot barley* or *Scotch hulled*. If the skin of the grain or bran is taken off, it is then white and clear looking, and is called *pearl barley*. This ground into flour becomes *patent barley*.


Hordeum Hexastichum.

The origin of barley is veiled in the misty past, and, like many of the cereals is unknown. It grows wild in Sicily, as also in Asia. The ancients claim that Isis introduced it into Egypt from Asia fifteen hundred years before the Christian era, while Pliny says it was brought by Ceres from Asia when she returned from the search for Proserpine, and she taught its use to the inhabitants of Sicily, at the same time she introduced wheat and rye, hence from her they were called *Cereals*.

Moses, in Genesis, says, "the flax and the barley were smitten, for the barley was in the ear, and the flax was in the boll;" this being one of the plagues that was sent on Pharaoh. Pliny says, further, it was the first food of mankind. That it formed a very important article of human diet is shown by the high estimation in which it was held by the earlier citizens of the world. God, in his promises to the Isrealites, speaks of the goodly heritage he had prepared for them: "a good land; a land of brooks of water, of fountains and depths that spring out of the valleys and hills; a land of wheat and barley and vines and figtrees and pomegranates; a land of oil and olive and honey; a

land wherein thou shalt eat bread without scarceness; a land whose stones are iron, and out of whose hills thou mayest dig brass." Barley is here placed with all that is good and beautiful. Gideon heard in the camp of the enemy one soldier rehearsing a dream to his fellow, that "a cake of barley tumbled into the host of Midean, and came unto the tent and smote it that it fell." Ruth also gleaning in the fields of Boaz until evening, and at night winnowed about an ephah of barley, which is about eleven gallons.

It was a legal tender among the Jews, as Solomon paid Hiram, of Tyre, in part with barley, as did also the Ammonites pay tribute to Jotham in barley and gold. Solomon used it as food for his horses and dromedaries.

By this it will be seen that barley has been in use from time immemorial, and in former times held a higher place as a food than it possesses now.

By the following table will be seen a comparative analyses of the various cereals.

100 Parts of	Starch.	Gluten.	Dexrine and Glucose.	Fatty Matter.	Cellulose.	Mineral Substances.
Wheat make	58.12	22.75	9.50	2.61	4.00	3.02
Rye "	65.65	13.50	12.00	2.15	4.10	2.60
Barley "	65.43	13.96	10.00	2.76	4.75	3.10
Oats "	60.54	14.39	9.25	5.50	7.06	3.25
Corn "	67.55	12.50	4.00	8.80	5.90	1.25
Rice "	89.15	7.05	1.00	.80	3.00	.90

Barley has been cultivated in this country from its earliest settlement, as in the proceedings of the colony at Martha's Vineyard it is stated that barley was sown in 1622, and at Jamestown the "London Company" sowed it in 1611 and, only a few years later, it was shipped from the Island of Manhattan to Holland by the Dutch colonists.

Little need be said about the cultivation of barley, as in most respects its growth and harvesting is similar to wheat.

It should be sowed either in the very early fall or very early spring. Of course the soil should be thoroughly plowed and pulverized. The land is greatly improved by subsoiling. By sowing in the latter part of August or early in September a large amount of pasturage will be available for the winter. Some farmers sow it with the last plowing of corn, in the latter part of July. If the field is accessible to stock, it makes but little difference how early in the latter part of summer it goes in the ground, but if not pastured it will be liable to joint. The kind of soil best adapted to barley is a light, rather sandy loam, rich and deep. Cold, wet, heavy soils will not produce it at all, as it will be more or less winter-killed. It will not pay a farmer to sow it on old, worn-out land; his expectations will always meet with disappointments. The land must be good. The quantity sown to the acre varies according to the soil. On good, mellow, rich land, from two to two and a half bushels to the acre will do, but on thinner land it will require more than that, as it does not tiller as well as wheat. This is for broadcast sowing. With a drill it will require much less. Great care should be exercised in the selection of seeds, as it easily spoils if exposed to too much moisture, and the grain becomes dark or reddish Good seed should be of a pale hue, lively and uniform. Good seeds will throw up strong, vigorous stems, capable of resisting any extreme of weather, and will ultimately grow with more luxuriance and strength than if the seeds are deficient.

CUTTING.

The time of harvesting must be closely watched, as more care is necessary at this period of its culture than at any other time, and a little, very little, remissness now, will cause the the farmer to lose his labor. It should not be allowed to get very ripe, and yet it should be ripe. The best way is "to wait until the longitudinal red streaks on the grain disappear, the head begins to hang down, and the straw

assumes a golden hue;" so says the London Field. It is very apt to be destroyed by wet weather, on account of the great amount of water held by the long beard and the abundant husk on the grain, and then its value as a malt-maker is destroyed. Hence it should not be stored until perfectly dry. It should not, for the same reason, be shocked until the dew is off. The best plan is to thresh before stacking, but if that is impracticable, let it be tied in small bundles and loosely shocked, or put into hand-stacks, and be extremely careful as to the capping. Let it be done so as to exclude every particle of moisture, and let it be threshed as soon as possible. When the heads once get wet, a stain appears, that will lower the grade and impair its value.

In threshing also, much care must be maintained, as the embryos of the grain are easily knocked off, which will prevent it from sprouting, and therefore, it cannot be used for beer. So the thresher must be run light, with fewer spikes than for wheat. After separation from the straw, it must be noticed daily to prevent heating, and it is better to spread it and stir frequently and sell as soon as dry.

Barley is capable of being cultivated in a greater diversity of climates than any of the cereals. On a very slight elevation near the Equator, it has, and is, successfully raised, and there two crops a year are secured, while it has also been cultivated in the frigid regions. Linnæus found it growing in Lapland in latitude 67° 20′, where the barley was harvested on the 28th of July, having been in the ground only six weeks. A gentleman in England sowed at the rate of five pecks on an acre on the 4th of February, and on the 4th of July harvested and secured fifty-two bushels and two pecks per acre. In both extremes of temperature it matures with astonishing rapidity, thus escaping the droughts of summer and the frosts of winter.

Barley takes from the soil a large proportion of mineral substances almost equal to wheat, and therefore it is necessary

that these substances, such as lime, magnesia, potash, phosphates, etc., should be applied to land sown with it. This is conveniently supplied in the form of ashes, land plaster, liquid manure, etc. Wolff's analysis shows Barley to contain albuminoids, 10,5; starch, 50.3; gum and sugar, 5.5; fat, 2.0; bran and crude fibre, 13.6; ash, 3.8; water, 15.7.

The quality of the grain is judged of by the quantity of water it absorbs when steeped in it; 100 parts of good barley gaining 47 parts of water. The old physicians used barley water very extensively in their practice, in febrile or inflammatory diseases, it being at once a cooling, soothing drink and possessing marked nutrient qualities.

It yields largely per acre; in Great Britain, the average crop of the kingdom being from 30 to 48 bushels per acre, while in the United States, it often reaches 60 bushels per acre. It is raised throughout the United States, sparingly in the South, extensively in the North. In California, the crop of 1870, reached 4,415,426 bushels. It will grow there four or five years with one sowing, and yield good crops every year. In New York, in the same year, the crop was 4,186,668 bushels; in Ohio, 1,663,868; in Illinois, 1,036,-338; Maine, 802,108; Wisconsin, 707,307; Pennsylvania, 530,714, and Tennessee, 75,068. The average crop for that year in the United States, was 15,825,898 bushels, thus showing the South to have produced a small proportion of the general crop.

The price has varied very much each year, sometimes reaching as much as two and a half dollars per bushel, and then selling at another time at fifty cents. The average price now for a number of years has been from 75 cents to one dollar.

As already stated, from the early ages of man, as recorded by both the imspired and pagan historians, barley next to wheat, has been more extensively used as a material for bread, than any other cereal. At one time, in England, it

took precedence of even wheat, and now, on the Continent, it forms the staple bread of the poorer classes. It is eaten as bread in parts of South Wales, and in the northern countries of England, and on the Continent.

Many writers say it is more nutritious than wheat. It is extensively used to make into a soup or broth to distribute from charitable institutions to the poor. The bread made from it is blackish, and has a strong odor, disagreeable to some persons. The Gladiators of Rome were fed upon this black bread, under the impression that its therapeutic qualities were such as to conduce to strength and endurance. It must have been an ignorant deduction, however, as gluten is the great strength producing principle of cereals and wheat, as will be seen from the table above, is largely in the ascendent in that ingredient, as compared with other grains. Barley bread is unknown to America, except on the prescription of a physician.

As a food for animals, Barley enters largely into the calculation of farmers. Not only is it fed to them as corn, but the growing Barley is extensively employed to carry stock through the winter, in place of other grasses. Sown early in the fall, or even in August, it will afford a fine pasturage through the entire winter, and not show any injury in its productive capacity. It grows rapidly, and wil. soon recover itself when relieved of stock. It bears pas turing better than wheat, and yields far more than ryel having more herbage. It can be used in this respect until the 15th of March, or 1st of April, if the season is backward.

From the first use of Barley, it has been employed as food for stock. At first, it entered so largely into the food of man, stock did not get a full supply, but after the later introduction of wheat, the practice of giving it to the inferior animals became general. The cavalry horses of Rome were fed, on the long and tedious marches into the enemy's country, upon it, as the transportation was not so difficult

as other kinds of food, each soldier providing himself with a sack, which he strapped to his saddle. They were thus enabled to make long and secret expeditions. Mixed with oats and fed to horses, it makes a most excellent grain food, and even now, in some countries, swine, fattened with it, bring a large price for the peculiar sweetness of the flesh, which is not only made more tender, but is said to increase in boiling.

Barley meal is a favorite swill feed for cattle and hogs in the portions of North Carolina and Virginia, where corn does not succeed well. It is fed to them in its first stages of fermentation. The grain is also, by some, soaked until it swells, and fed in that condition. Barley straw, cut fine with meal sprinkled over it, is an excellent food for cattle and horses, but especially for milk cows, as it increases, both the flow and richness of milk. In Arabia and Egypt, where the most celebrated horses of the world are bred, th almost sole food they receive is Barley, in its natural state, without either cooking or grinding. There is a prejudice in the minds of some, that Barley, fed alone, possesses heating properties, but when we see its good effects in this nursery of horses, and in a country naturally far warmer than this, we should no longer hesitate in its use. It is comparatively free from diseases and from the depredations of insects; it produces more to the acre than wheat or rye, and will make good crops with less cultivation and on poorer land than corn, and yet, in Tennessee, the use of this valuable grain as a stock food, is not what it should be. It has so long been consumed by the brewer, that any other use is not thought of. It can be used as a food, from the time the shoots come out of the ground first as a pasture; then as grain and hay. It fills every indication required, and besides, if the wheat bin becomes exhausted, there is a neverfailing supply of batter-cakes, equal to buckwheat, to carry the family to the next crop.

As a theraputic agent, barley, as before stated, has a very

considerable reputation among physicians. It has much less of the flesh-forming principles in it than wheat and, as a natural consequence, is admissible in all inflammatory affections, where a cooling diet is desired. However, there being a superabundance of starch in it, the gastric juice meets with more resistance, and it, with the bran that is unavoidably in it, produces a laxative effect, so that it would not be suited to bowel affections, especially for diarrhœa or indigestion. But in kidney, lung or liver diseases, where a cooling, demulcent and nutritious food is desirable, it is well adapted. Bread, with three parts wheat and one of barley, is a good food to counteract the effects of constipation, both in infants and adults. Decoctions and infusions of barley were used formerly, as febrifuge drinks, more than at present, but are still good.

It has been stated that the brewers get the largest proportion of the barley raised in the State. It is used by them for the purpose of making beer and ale. This is a comparatively new industry in the State of Tennessee, and is increasing at such a rate that a market for all the barley likely to be raised will be always at hand. This fact is well established, when it is known that the brewers of Nashville have to resort to the North for their main supply.

Beer or ale is becoming such an universal drink that more breweries are being constantly built up. As to the morale of its use, we have nothing to say; but it is taking the place, in many families, of tea, coffee and milk, and there are numbers of persons who never drink water at all, quenching their thirst by the use of this beverage. It is strongly recommended by some temperance advocates as an antidote to intemperance; its mildly intoxicating qualities seeming to satisfy the cravings for stimulus. It may be interesting to the public to know, in a few words, the process of beer-making. Without going into details, the barley is first soaked in water about two days, until it increases

about forty per cent. in weight, and until it can be easily pricked with a needle. It is then piled in heaps to germinate, which it will quickly do, when it is spread on a floor, two or three inches thick, to secure uniformity of sprouting. This is a nice operation, and is stopped just as the gluten and mucilage has mostly given way to sugar, and if it should go too far the sugar would become acid and the barley lost. At the proper stage of fermentation the grain is kiln-dried, so as to destroy all vitality in the seed. Next, the grain is ground, then *mashed*, that is, it is stirred in just water enough, at 160°; to thoroughly wet it, then water, at 194°, is added, and it is allowed to stand three or four hours and then boiled in large copper vessels by means of steam pipes. At this stage, one pound of hops to a bushel of malt is added, and the whole mass frequently stirred. After being sufficiently boiled, it is strained, by being drawn into vessels with perforated bottoms, and then exposed in broad shallow cisterns, with a stream of air passing over them, for cooling rapidly. When cooled down to about 60°, it is drawn into vats and the yeast added, one gallon of yeast to 100 gallons of the liquid. Now is the critical time of making good ale or beer. In a short time fermentation begins, and the operator watches day and night the process, so as to take it at the precise point. Now is the time the different kinds of malt liquors are made. Ale, pale-ale, lager and bock beer, porter and all the endless varieties of these drinks are determined by the amount of fermentation; and this process is of so much consequence, that a man well skilled in it will receive, in a large brewery, enormous wages such as a man in no other kind of business or profession will command, even $20.000 a year having been given some. When the proper point has been reached, the liquor, to avoid the loss of the alcohol, the aroma of the hops, and also to escape souring, is put into hogsheads with the bung hole open. It here remains and the froth escapes, carrying off all sediments and

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foreign substances until the process is completed, and then it is transferred to tight strong casks, in a cool celler, to await the consumer.

Appended is an analysis of some of the celebrated brands of beers:

	WATER.	MALT.	ALCOHOL.	CARBONIC ACID.
London Ale	76.03	15.88	8.08	0.01
London Pale Ale	89.85	4.50	5.65	
Double Porter	88.74	5.98	6.10	0.18
Philadelphia Lager Beer	92.16	4.36	3.40	0.08
Reading Lager Beer	91.30	4.66	3.76	0.13
Walters Lager Beer	91.80	4.65	3.44	0.11
Bavarian Lager Beer	90.95	4.70	4.34	0.04

Malt-making can only be prosecuted in the winter months, or when the thermometer is below 45°, as in warm weather the grain becomes mouldy.

BROOM CORN—(*Sorghum Saccharatum*).

Spikelets clustered or scattered in an ample panicle, each with one perfect and one central or staminate flower; without silky down; glumes russet brown, coriaceous; stems not hollow, pithy; leaves, linear: ligular, short and hairy; villous, oblong florets, and yellow oval seeds. Flowers in August.

Broom Corn is a native of India, and was introduced to the United States by Dr. Benjamin Franklin, who accidentally saw a single seed on a broom, in the possession of a lady friend, imported from India. He planted it in his garden, raised a stalk, distributed the seed, and hence its origin as an agricultural product in America.

The credit for the industry of broom-making is due the Shakers; who in 1791, at Watervliet, New York, first began to raise broom corn in their gardens. This they made into brooms, and sold them at 50 cents each. Their machinery was very simple, and the handles were made of white soft maple wood, and turned with an ordinary foot-lathe. The

Shakers at Union village, Ohio, soon learned the trade, so that it was, essentially, for many years a Shaker trade.

Before the war, it was an almost unknown agricultural product of the South, at that time being confined to a few patches belonging to the slaves. But after the war it came into notice, and the fortunate few who began its cultivation realized such enormous profits, it attracted general attention and it at once sprung into popularity. Soon, however, it was overdone, and the price fell in one year, from a surplus production, from 12½ cents to 2 cents per pound. This so discouraged farmers, that it has been touched with hesitation ever since, and its price, since 1870, has never, at any time, ceased to be remunerative. At this time, its cultivation is very generally carried on throughout the United States, and it forms one of the staple productions of Tennessee. We have no statistics of its growth in either the State or general government, but that Tennessee produces more than she wants, is shown by the fact that a large quantity is annually shipped to Cincinnati, St. Louis and Boston, and several large broom factories are in successful operation.

No crop, at maturity, presents a more beautiful appearance than broom corn. Its stalks grow, on good land, from twelve to fifteen feet high, and its heavy panicle waves to every passing breeze like a plume. The stalks are hard and worthless, unless stock can be turned on a field immediately after cutting, or before frost, when they will strip the fodder to some extent. Some farmers will gather the fodder and use it as sheep provender during the winter, but though eaten, it is not with much relish. The seeds, formerly, were quite valuable, and in fact were fully worth the cost of production. But, of late, it has been ascertained that when cut while the seeds are in the milk, or at farthest in the dough state, the straw is much brighter and brings a higher price. Consequently, the seeds are not nearly so valuable. They are chiefly valuable for sheep, which are readily fattened by them. Ground, and mixed with corn, oats, rye

or barley, they are good for any kind of stock, and are excellent to fatten cattle. Mixed with wheat bran, their value is greatly increased, and a cheaper or better food for poultry cannot be found.

If intended for feed, the seeds should be taken up as threshed and spread on the barn-floors or scaffolds until thoroughly dry before being stored. Too often, however, the thriftless farmer, looking upon it as a small business, or being too busy with preparing the straw for market, will allow them to accumulate in a great heap, and, being yet green, they quickly heat and rot. That this is reprehensible in the highest degree, is apparent, when it is stated that on the best land, as much as fifty bushels of seed are raised per acre, less in proportion to the character of the land. Thus, in a large crop, the farmer is throwing away good stock food, enough to supply all the animals on his place with an abundance of good grain during the winter, compelling too often during winter his cows and stock cattle to browse on barren wastes, with the bonus of a few shucks at night. No wonder that the March winds blow away so many of the cattle.

The seeds should be planted in drills, three feet apart, and about 12 or 18 inches in the drill. Four-quarts will be amply sufficient to plant an acre. In Tennessee, planting is done almost exclusively by hand, but there are machines that will plant far more regularly and evenly, than can possibly be done otherwise, and by using one, there will be no necessity for laying off rows, covering, or thinning out. With a machine, the planting can be soon finished, as one man will plant from 10 to 12 acres a day, the planting being in two rows at once. Any ground that produces a good crop of Indian corn, being well prepared as in all other crops, is suitable for Broom Corn, but rich, alluvial bottom is the best, and will make the largest returns Thin land will make, possibly more Broom Corn than any other crop, but still it will not make a paying quantity. In

four or five days, if the weather is favorable, the seed will germinate and the grass-like blades will make their appearance above ground. The after-cultivation is easy, by using the walking cultivator, and its growth is so rapid that it will not be necessary to go over it more than twice, if the ground is well harrowed before planting. By using this implement and a seed drill, one hand can easily cultivate thirty acres, and, even more, if he calls in assistance in preparing the land, for with a cultivator one row is plowed each time going across the field. So, with two horses, one man will clean well seven or eight acres per day. Of course, without these improved implements, and with less careful tillage, the crop would come down to ten or twelve acres per hand.

The time of planting, is from the middle of April to the middle of June. It must not be planted while there is danger of frost, and if it is delayed too long, the dry weather will lessen the product.

As before stated, the best time to harvest the crop, is when the seeds are in the milk state, or, at furthest, in the dough state. At this period, the straw is light-colored and bright, and will bring the maximum price. If the cutting is delayed until ripe, the straw becomes more brittle, and assumes a red color, and that kind always brings the minimum price, and besides is not so strong or durable.

And now begins the real labor of the crop. The old plan was to bend the corn down, three or four feet from the ground, and leave it thus four or five days to dry. But in this way, the work of after-harvesting is increased, and besides, the straw will become, to a great extent, bent or twisted, and this, also, detracts from its value. Now, the common custom is to "table it," and this process is performed in the following manner:

It requires the united work of four hands to expedite the job, though any number can work at it. One hand on each row will break the stalk off, or rather bend it about

four feet from the ground, at an angle, so as to cross over the opposite row towards the rear. The two first stalks in each row must be twisted together, so as to form a rest for the beginning. After that, they will lie on each other, forming a flat of the two rows, the brush, with a portion of the stem, projecting rearwards on the opposite side from where it grew. The two hands following after on each side will cut off the bush, with stems attached, six or eight inches long and lay it upon the "table" made by the bent corn. It can here remain, according to the weather, until, if the latter is favorable, it becomes nearly dry. It must be carried to the barn, or other shelter, and "poled," or spread on lathes, or resting poles, which extend across the barn, and left there until it becomes perfectly dry. In no other condition is it merchantable, except at an inferior price.

In the meantime, while drying, it is also stripped of its seed, which is done, either by hand, horse or steam power, by threshers made for the business. A good horse-thresher will clean about three acres per day; steam, more; hand-power less. After threshing, the drying process is completed, and it is ready to be baled.

Every man who raises it to any extent, should provide himself with a press, which can be cheaply made, by putting a lever in a tree, post, or in the side of a barn, having two, strongly batoned sides to shape the bale. Tobacco prizes will answer for baling. In baling, the farmer should use wire, and lay the corn straight; tie securely, and trim the ends squarely. A neat, tight, well-made bale will command a quick sale over a slovenly-made one, even if the corn is not so good. After the crop is off, the ground should be rolled and a three-horse plow passed over it, so as to turn the stubble into the soil. By so doing, it will rot, and the ground will be light, loose and fertile for another crop, the amount taken off being small in proportion to that raised on the ground. Some cut the stalks and carry

them into the barn-yard for littering purposes, others fill up gullies, too many of which are seen on our fields, while, by far the largest number allow them to remain until spring, then drag and burn them. Some of the finest crops of Indian corn I ever saw, were raised on burned land, the salts of the ashes simulating greatly the crop.

The average crop of one acre in this State, may be put at five to six hundred pounds, dry bush. On good bottom land, one thousand pounds may be easily raised, and occasionally on extra land, twelve hundred pounds may be secured. But no farmer must expect to raise even five hundred pounds on poor land, or disappoinment will be his portion, as it takes good average land to make even this yield. The cost of cultivating and marketing an acre is about as follows:

Breaking up ground	$ 1.00
Harrowing twice	1.00
Planting with hand	1.00
Plowing twice	2.00
Breaking and cutting	4.00
Hauling, threshing and drying	4.00
Wire and baling	2.00
Rent of land	5.00
Total cost of one acre	$20.00
Credit by 600 pounds bush. at 6 cents, the average price for the last few years	$36.00
By seed, 50 bushels, worth, say 25 cents	12.00
Total	$48.50

Net profit, $28.50 per acre.

In this estimate the seeds are placed at half the value of oats, there being no market value for them, and it is admitted, by all agricultural writers, that broom-corn seed are fully equal, in value as feed, to oats. Then, the quantity of seed per acre is fully low enough to make due allowance

for the shrinkage consequent upon early cutting. Besides the net profit, much of the expense will go into the farmer's own pocket, as most of the work, or all of it, will be done by the ordinary labor necessary to carry on the farm. So, really, the profit of a crop of broom-corn is fully equal to that of any other crop now planted in the State, and greatly surpasses many of them. Several objects must be kept constantly in view in the culture of broom-corn:

1. Cut and cure it as green as possible, consistent with the ripening crop.

2. Handle neatly and do not cut the stalks too long that go with the brush.

3. Dry thoroughly as possible to prevent moulding, the succulent pith greatly favoring it.

4. Bale tightly, and in all cases trim the ends of the bales with as much precision as possible, a ragged, jagged bale never bringing its value.

There is another view to be taken of broom-corn. No farmer who carries on a farm of any size, whether with hired labor or with his own sons, but finds many unemployed days during the summer and winter, both from inclemency of the weather and other causes. Let him raise, in addition to his market crops, a few acres of broom-corn for home manufacture. The cold, rainy days, and long, tedious nights of winter can be passed in making brooms. With special care he can always count on one ton of good straw, all raised by his own labor. One ton of brush will make from 1,200 to 1,300 brooms. The wire, handles, braces and twine in one broom will average three cents. The cost of a complete outfit for making brooms, the best machines, is fifty dollars. Two hands will make one broom every five minutes, so that, after supper, until nine o'clock, two hands will turn out not less than two dozen brooms, worth at this time, $2.50 per dozen, sometimes $3.00. If he would take the trouble to retail them, he would receive $5.00 per dozen. In this manner, without losing any time

from his other work, a farmer could realize a good profit from every acre of broom-corn planted, and the work is not at all tedious, on the contrary, being noiseless, it would not interfere with conversation or reading by one member of the family. These suggestions are thrown out, particularly to that class of our fellow-citizens, who must pay rent, and find it so difficult to make the two ends meet, with large families to support; but they are equally applicable to all classes, who, by industry and economy, would escape that most horrible of all conditions, being in debt; for with the best of management, "he who sows land reaps more care than corn."

CHAPTER XXII.

BUCKWHEAT—DHOURO CORN.

BUCKWHEAT---(*Polygonum fagopyrum.*)

This is one species of a weed comprising many varieties. It has alternate, entire leaves, having stipules in the form of scarious or membranous sheaths at strongly marked, usually tumid joints of the stem; leaves triangular-heart-shaped inclining to halberd-shaped or arrow-shaped on long petioles; sheaths half cylindrical; flowers white, or nearly so, in corymbose panicles; stamens 8, with as many honey-bearing cells interposed; styles 3; acute, triangular, large akene.

The botanic name is from the Greek, and the common name from the German, and both mean Buckwheat, from the similarity of the grain to the beech-nut.

Buckwheat has never received that consideration due it as a field crop, from the fact, that other grains succeed, as a rule, better, in Tennessee. Where mostly raised even, it is generally sown as a substitute after the failure of other grain crops, the short period of growth allowing it to come in. Its cultivation thus is very fluctuating, one year the crop of the United States being only 14,972 acres, the next year being 149,445 acres. It is rarely sown before the middle of June, and can be sown later in July, as it only requires from 80 to 90 days to mature. However, it is never allowed to fully mature, as it continues to bloom and fruit until frost, and the judgment of the farmer must be exercised as to the time when

it is full of kernals. It is not only a food for man, but is as good for stock, fattening horses, cattle and hogs. It is nearly as nutritious as oats, can be raised as cheaply, and the yield is about the same, ranging from 25 to 40 bushels per acre.

It yields on grinding about 331-3 pounds of flour per bushel. The flour is used extensively in the United States for making breakfast cakes, but in Europe it is used for bread. East Tennessee has devoted a considerable portion of land to its culture for many years. A gentleman in Greene county sowed it the 6th of July, and harvested about 30 bushels per acre, on the 9th of October. Two quarts sown one year made four bushels of the grain. It does not succeed well on rich land from its disposition to lodge, but on poor, thin land, especially with a good proportion of clay, it does exceedingly well. It would, no doubt, be a remunerative crop for the uplands of Tennessee, especially the Cumberland table lands. It is exceedingly sensitive to cold, the slightest frosts destroying it, but it requires so short a time to mature that it can be successfully grown in our shortest summers and in the highest latitudes. It does not seem to injure the land on which it grows, and consequently can be raised successively for many years on the same soil. This is due to the fact that it derives its principal nourishment from the atmosphere, and for this reason it is that poor soil will make good crops. The flowers are abundant and abound in honey, though of an inferior quality, and from the time of inflorescence it is covered with bees. Some apiarians sow it solely for the use of their bees.

There are several varieties, each receiving a local name, and each having its defenders, as the best quality. There is the *rough*, the *smooth*, the *gray*, the *Scotch gray*, and the *silver hull*, or *serrazin argente*, a French variety with a grayish colored hull. This last is named from the Saracens, who were supposed to have introduced it into Spain in the

eighth century, and brought it thence into France. This variety is at present the favorite in sections devoted to its culture, its adherents claiming that it will produce more in a shorter time than any other variety. It can be sown in July, and harvested in September, and usually yields thirty bushels per acre.

The proper quantity to sow is one bushel per acre. This is sown on ground previously broken up and plowed in. It produces such a mass of leaves that the ground is thoroughly shaded and all weeds are stifled. Twelve bushels will pay all the expenses of cultivation which leaves any surplus a clear profit. The average crop in the United States in 1873, was 18.1 bushels per acre, which is more than twice that of wheat. It does not stand extremes of heat or moisture, but in the middle States it is never too dry for it. It has been raised in South Carolina successfully, and in Virginia and North Carolina it is one of the standard crops. As far North as Wisconsin, Prof. Daniells experimented with it. He sowed eight quarts of seed weighing thirteen pounds on seventy-two square rods of ground on the 28th of June. The growth was very slow on account of dry weather. When not fully ripe on the 30th of September, he harvested it, and got 526½ pounds of grain, which was at the rate of 27½ bushels per acre. One bushel weighs 46½ pounds. Had it been fully ripe the yield would have been much larger, but it had to be cut to escape frost. If it can thus be grown in the chilling atmosphere of Wisconsin, and on the hot sands of South Carolina, there is no reason why it should not be successfully and generally cultivated in all parts of Tennessee, especially as before stated on our thin lands. It would make a fine substitute for wheat for man, and of oats for animals, and nothing could be better than to sow it on the lands in such a year as the present, that have failed to bring good returns of wheat, and in fact, it can be sown any year after the harvesting of wheat and oats, on the same ground. It is sometimes plowed in while

green, as a manure, and often it is cut and cured as hay for stock, they eating it greedily.

At the proper time for cutting it is cradled and set up to dry, there being no danger of its grains sprouting from wet weather. When dry it is placed on a floor of rails over a pen and beat out with the flail. It can be ground and bolted in any of the common mills of the country. Requiring no barn to be housed in, it is thus within reach of the pooest tenants as well as the rich farmer. Its average price for the last thirty years is one dollar per bushel, which is far better than can be procured from oats.

It is a native of central Asia, and was brought into Europe by the Crusaders, in the 12th century. It was cultivated on the Hudson river as early as 1626, by the Dutch, and on the Delaware by the Swedish colonists, and was sent back to Europe in that year as a sample of the products of the country. At that time, however, it was chiefly fed to horses, and it was not used extensively as human food until during the last century.

In 1840, the product of the United States was 7,000,000 bushels; in 1850, 8,956,912 bushels; in 1853, 10,000,000 bushels; in 1868, 1,052 acres were sown in Tennessee, producing 12,000 bushels, at a value of $14,520. In 1874, Tennessee produced 76,000 bushels, and in 1875, 105,000 bushels, while in the United States the same year, there were 10,082,100 bushels produced on 575,530 acres of land. In 1876, the last report we have in the United States, 9,668,800 bushels were raised, and in Tennessee, 97,000 bushels on 5,914 acres of land that brought into the State $80,510. It is thus seen, that though raised but little, except in one section of the State, its value is superior per acre, to the wheat crop.

We cannot close without again urging the farmers of the Middle and Western Divisions to cultivate this crop. It is freer from diseases than any other crop of grain, requires less cultivation, is more easily harvested, requires no

heavy outlay for housing, can be sown after other crops are laid by, or have failed, and yields as much per acre as oats or barley, and far more than wheat or rye. Its analysis is as follows, as given by Boussingault:

Water	14.0
Gluten	9.0
Starch	48.0
Gum	2.5
Sugar	2.5
Fat	1.6
Woody fibre	20.8
Mineral Matter	1.6

Or economically.

Water	14.0
Flesh formers	9.0
Fat Formers	52.1
Accessories	23.3
Mineral matters	1.6

To show its relative value as compared with other cereals we give a table of comparative equivalents of nutritive elements of grains and seeds, flour being the standard, and placed at 100.

Wheat flour, good quality	100
Wheat	107
Barley meal	119
Barley	130
Rye	111
Buckwheat	108
Indian corn	138
Yellow peas	67
Beans	44
Rice	171

This table, however, refers to their *nitrogenous* values and their fattening qualities differ greatly as will be seen by the tables appended to each grain as treated in the series. In the above table, 100 parts of wheat flour is equal to 107 parts of wheat, 138 of corn, 108 of buckwheat, etc. The value of the green stalks of buckwheat as a hay is shown in the table below:

SUBSTANCE.	Timothy.	Red-top.	Red clover.	White clover.	Buckwheat stalks.	Pea stalks	Green oats.	White, field bean.
Water	70.0	71.0	76.0	80.0	82.5	80.00	82.0	85.0
Starch	5.5	3.8	1.4	1.0	4.7	3.40	5 0	1 5
Woody fibre	12.5	13.0	13.9	11·5	10.0	10.31	7.5	9.0
Sugar	4.2	4.9	2.1	1.5	....	4.55	3 5	0.2
Albumen	4.0	3.3	2.0	1.5	0.2	0.90	1.0	1.05
Gums	1.8	1.5	3 5	3 4	2.6	0.90	0.5	2.25
Fatty matter	....	....	0.1	0.2	....	0.65	....	1.0
Phosphate of lime	2.0	2.5	1.0	0.9	....	0.19	....	....

A careful examination of this table, prepared from the best American, English and German authorities, and a comparison of the many value of these articles of food, modified as experience shall suggest, with their feeding value as here given, would be of immense benefit to the farmers and save them thousands of dollars often injudiciously expended.

I append another table of analyses made by Wolff and Knop, showing comparative value of cereals.

GRAINS AND SEEDS.

SUBSTANCE.	Water.	Organic Matter.	Ash.	Albuminoids.	Carbohydrates, etc.	Crude fibre.	Fat, etc.
Rice	14.6	84.9	0 5	7 5	76.5	0.9	0.5
Winter wheat	14.4	83.6	2.0	13.0	67.6	3.0	1.5
Wheat flour	12.6	86.7	0.7	11.8	74 1	0·7	1.2
Spelt	14.8	81.3	3.9	10.0	54.8	16.5	1.5
Winter rye	14.3	83.7	2.0	11.0	69.2	3.5	2.0
Rye flour	14.0	84.4	1.6	10.5	72.5	1.5	1.6
Winter barley	14.3	83.4	2 3	9.0	65.9	8.5	2.5
Summer barley	14.3	83.8	2.6	9.5	66.6	7.0	2.5
Oats	14.3	82.7	3.0	12.0	60.9	10.3	6.0
Maize	14.4	83.5	2.1	10.0	68.0	5.5	7.0
Millet	14.0	83.0	3.0	14.5	62.1	6.4	3.0
Buckwheat	14.0	83.6	2.4	9.0	59.6	15.0	2 5
Vetches	14.3	83.4	2.3	27.5	49.2	6.7	2.7
Peas	14.3	83.2	2.5	22.4	52.3	9.2	2.5
Beans (field)	14.5	82.0	3.5	25.5	45.5	11.5	2 0

DHOURO CORN, DURRA OR DOURA, INDIAN MILLET—(*Sorghum vulgare*).

Stems pithy, about eight feet high, spikelets clustered, each with one perfect and one neutral or staminate flower; no silky down; glumes russet brown, coriaceous; leaves long, linear, and recurved as Indian corn; annual. Cultivated for its seed.

In the West Indies, it is called *Guinea Corn*, in Arabia, *Dhouro*, in India, *Jovaree*, and in China, *Nagara*. In some countries it is cultivated as a forage plant, the stems containing a large proportion of saccharine matter, and when dry affording a fine hay, though rough. The nutritive quality of the seeds nearly equals that of wheat. From its resemblance to Indian corn, in the south of Europe it is called *Small Maize*. On rich land it grows from eight to twelve feet high, and it produces more bushels of seed, than an other known cereal, to the acre.

There are several varieties of this cereal, being sports from the original. Chocolate corn, Tennessee rice, Chicken corn, are some of its synonyms. It is a native of Central Asia, and is cultivated extensively in Asia, Africa, West Indies, Brazil, and in the southern parts of the United States. It will grow to perfection from Pennsylvania to Florida. There are two varieties usually cultivated, the "White" and the "Red," both good, but the red produces a great many more seeds—some say as many as four times the quantity of the other. The red matures earlier, too; the white, being in higher latitudes, is often caught by frosts. The latter, however, is preferable when intended for food. A failure of this crop in Arabia and Africa, would be as great a calamity as that of corn in the United States. The meal is white and makes delicious breakfast cakes, and is said to be much better than corn meal.

Its yield varies according to the soil on which it is sown. On rich sandy loam or alluvial bottoms, it will make from 100 to 150 bushels per acre, but unlike the other cereals, except buckwheat, it will grow well on soil however poor.

On rocky, clayey land, that will scarcely sprout foxtail, I have seen the most luxuriant crops. It will continue to grow until frost, and after the first head matures it throws out suckers from other joints, and makes smaller heads. This is expedited by going over it and culling out as fast as it ripens. Stock of all kinds are fond of it, and will greedily eat it. It is almost equal to Indian corn as a fattening food for hogs.

The ground is plowed as well as possible, and then thrown into low ridges, or even better no ridges at all; the seeds are then drilled three feet apart, with a seed drill. If sown by hand, the rows are made with a bull-tongue plow and covered with a harrow. A peck of seeds is enough for an acre, unless they are weevil eaten, when more should be used. They should be covered very lightly, not more than an inch and a half deep. When they come up they should be thinned out by chopping across the row, leaving the plants eighteen inches apart, then one or two good plowings are all the crop requires. There need be no fear of weeds or grass after it once starts out to grow, as its enormous foliage, and thickly clustering suckers choke out everything else on the ground. It grows very rapidly, and will soon be ready for harvesting. There are various ways for doing this, according to the fancy of the farmer. Some cut of the seed heads as they ripen, and turn stock on the stalks, which will eat them up quite clean. Others will cut the stalks just before frost, stacking them and feeding them as hay through the winter; and these stalks will keep better than any other of the pithy grasses, not souring like Indian corn or sugar cane. Still others wait until the largest quantity of seeds is ripe, and then cut, and house seeds, stalks and all together, If the fodder is pulled it makes excellent feed, in fact every part of the plant makes good feed for some animals. Care should be exercised to protect it from fowls, as they are so fond of the seeds that, frequently, whole fields are stripped.

It is often planted in the missing places of corn, and it does far better than a replant of corn, as one stalk will throw out numerous suckers, making several large heads and ripening with the corn. Drought has but little effect in retarding its growth. It retains its dark green color and luxuriant foliage when other plants are shrivelled up by the heat.

In the south it is sown thickly in drills, and cut for soiling stock, and if not allowed to flower, it will bear cutting until frost comes. Many sow it broadcast for hay. Prepare the ground well and sow one bushel of seed to the acre, harrowing it in. It makes an enormous yield of hay, but, from the succulent character of the stalks, it is difficult to cure, unless a good "spell" can be caught. However, if the farmer has a drove of mules or steers to fatten, he can cut a load or two at a time, throwing it into a rack, which can be replenished as required, and the hay will remain green on the ground until frost, so that there is no danger of its being lost by becoming too ripe.

In Germany the seeds are deprived of the chaff, and used as rice, and sells for the same price. In Asia and Africa it is made into a meal and eaten, either in gruel, cakes or bread. It can be sown at any time from the first of April, (a light frost not injuring it,) until the first of July.

If fed on the ground the stalks will remain in the way of the planter for a year at least, but if plowed under in the fall, like broom corn, they will rot by spring, and if lime is sown on them *before* plowing under, it will greatly expedite the process, and the soil will improve every year.

Taking into consideration the fact, that it will yield more seed, fodder and stalks on a greater variety of soils, with less labor, in any kind of season, and return more litter to the land than any other cereal, and being a good food for man and beast, it may be justly considered one of the most valuable of the cereals. And with these facts it is most surprising that it is raised to the small extent it is.

About twenty-five or thirty years ago, it could be seen on the plantation of almost every farmer in the State. It gave very general satisfaction, and yet it went out as suddenly as it came into popularity. This was due to the cry that it impoverished the land. This verdict was accepted without question, and its culture abandoned; but it is manifest, from subsequent experiments, that it detracts as little from the fertility of the soil as any other cereal, much less than some.

If the stalks are left and only the grain and fodder removed, and the former fed on the field, and plowed in as before stated, the soil will not be greatly injured. It will not kill cattle like clover, and no care is necessary but to salt and water them. One would be surprised how quickly cattle will fatten on the bare stalks, and besides they will leave the ground covered ankle deep with manured stalks.

With all these facts before us, and our own experience in its cultivation, we most heartily commend its use to the citizens of Tennessee. There is no character of soil, from the rich alluvial bottoms of the Mississippi to the sterile mountain lands of East Tennessee, but what will make good crops of Dhouro Corn, and we would like to see it on every farm, if for no other use than as feed for fowls.

The following analysis of the green fodder and green clover will show their comparative values:

	Water.	Organic Matter.	Ash.	Albuminoids.	Carbo-hydrate.	Crude Fibre.	Fat.
Red Clover in blossom	78.0	20.3	1.7	3.7	8.6	8.0	0.8
Dhouro	77.3	21.4	1.1	2.9	11.9	6.7	1.4

It has more heating properties and more fat producing principles than red clover, but is not so rich in flesh formers.

CHAPTER XXIII.

INDIAN CORN—(*Zea Mays.*)

Stem terminated by the clustered, slender spikes of staminate flowers (the tassel) in two-flowered spikelets; the pistillate flowers in a dense and many-rowed spike, borne on a short axillary branch; (the ear) two flowers within each pair of glumes, but the lower one neutral, the upper pistillate with an extremely long style, (the silk.) Stem strong, jointed, five to fifteen feet high, with large, alternate leaves starting from each joint, monœcious and annual.

Each plant bears from one to six or eight ears which are cylindrical, and enclosed with a covering of leaves called shucks or husks. The centre of the ear is pithy called cob, and on the cob are arranged rows of grain, numbering from eight to thirty-six; usually twelve to fourteen rows. The number of grains in a row is usually thirty to forty. These grains are rounded on the outer surface, flattened on the sides, and the germ is near the point, and from the germ a long, silk or style extends under the husk to the end where they all unite in a silky cluster. The pollen from the tassel falls upon these silks or flowers, thus fertilizing the grains. Without this pollen the seed would not germinate nor would the ear be completed, as may easily be tested by cutting off the tassel before the silk appears. On a bright day the pollen may be seen in the sunshine, rising

in clouds, with every stirring breeze. The name given by the Indians to this cereal was Mondamin, meaning life, and so the name given by botanists is in deference to the cognomen of the aborogines, Zea, meaning life in the Greek.

HISTORY.

It may be remarked that the early history of the bread plants is enveloped in obscurity, and come to us in the form of traditions, and myths. according to which the gods themselves descended to the earth to confer these great gifts on mankind. In India it was Brahma; in Egypt Isis; in Greece and Italy it was Ceres or Demeter, who not only brought them to the inhabitants, but taught them their uses. Maize being unquestionably of American origin, has its legend also of the birth of so noble a grain, and upon this allegory our Longfellow has founded his Indian Epic Hiawatha. The legend is given in Schoolcraft's history of the Indian tribes of North America, and is located among the Odjibwas. It is as follows:

"A young man went out into the woods to fast, at that period of life when youth is being exchanged for manhood. He built a lodge of boughs in a secluded place, and painted his face a sombre hue. By day he amused himself in walking about, looking at the shrubs and wild plants, and at night he lay down in his bower which, being open, allowed him to look up into the sky. He sought a gift from the Master of life and he hoped it would be something to benefit his race. On the third day he became too weak to leave his lodge, and as he lay gazing upwards he saw a spirit come down in the shape of a beautiful young man dressed in green, and having green plumes on his head, who told him to arise and wrestle with him, as this was the only way in which he could obtain his wishes. He did so, and found his strength renewed by the effort. This visit and the trial of wrestling were repeated for three days, the youth feeling, at each trial, that although his bodily

strength declined, a moral and a supernatural energy was imparted which promised him the final victory. On the third day the Celestial visitor spake to him: 'To-morrow,' said he, 'will be the seventh day of your fast, and the last time I shall wrestle with you. You will triumph over me and gain your wishes. As soon as you have thrown me down strip off my clothes and bury me in the spot, in soft, fresh earth. When you have done this leave me, but come and keep the weeds from growing on the place. Once or twice, cover me up with fresh earth.' He then departed, but returned the next day, and, as predicted, was thrown down. The young man punctually obeyed his instructions in every particular, and soon had the pleasure of seeing the green plumes of his sky-visitor shooting up through the ground. He carefully weeded the earth, and kept it soft and fresh, and in due time was gratified at beholding the matured plant, bending with its rich fruit, and waving its green leaves and yellow tassels, in the wind. He then invited his parents to the spot to behold the new plant. 'It is Mondamin' replied his father—'it is the spirit's grain.' They immediately prepared a feast and invited their friends to partake of it, and this is the origin of Indian corn."

Among all the crops of the United States Indian corn takes precedence in the scale of crops, as it is best and most universally adapted to all conditions of climate and soil, and furnishes the largest amount of nutritive food. With proper attention to its cultivation, and the selection of best varieties, it may be accounted a sure crop, as well in the ice-bound regions of Canada as in the torrid sands of California, in fact its culture extends between the latitudes of 45° north, and the same in the southern hemisphere.

Cotton has received the name of "King." But if in America any plant can be said to have dominion over all others, both on account of its universal use and its importance to mankind, both as human and animal food,

that title is due to corn. Its cultivation is not like cotton, confined to one belt or to one soil, but it will grow on the sandy hills, or the alluvial bottoms, on the moist savannahs of the South, and upon the highest peaks of the Eastern States, it having been successfully grown on elevations eight thousand feet above the sea.

An expressive mode of representing the range of this staple is, by reference to extreme points on the several meridians of longitude, from the Atlantic coast westward; and though we have no abrupt limits at the South other than those of the continent itself, or none in climate at least, we shall find the measure of distance on these lines of longitude of some service. The bay of Fundy and the valleys of New Brunswick bring this cultivation up to the 46th parallel, at from 64° to 67° of west longitude. In the highlands of Maine it falls off to less than 45°, and in New Hampshire to 44°. But it then rises abruptly to 47½° at St. Anne's and at Quebec 72° west longitude. The mountainous parts of New York and some parts of Western Canada, between the Ottowa river and Lake Huron, permit no cultivation of this crop; but the river valleys and better portion of the country have some adaptation to it, to the 46° of latitude, as far west as Lake Huron at 82° of west longitude. The influence of the lakes and the elevation, reduce the summer temperature so much at this point, as to throw the limiting line southward to 45° of latitude, and this line continues west almost to the Mississippi. Passing this elevated district and approaching the warmer summer of the plains, it goes abruptly north to 50° of latitude, at Lake Winnepeg 97° west longitude. This is probably its highest point, and measured on this meridian we have 23° of latitude in the United States, and the whole amount of 35° for the American continent, as the range of a single cultivated staple, and everywhere on this line, it is at least equal to any other in value. Westward of this line the range becomes so irregular and exceptional between the ex-

treme points, that the comparison is not of the same value. Localities of the upper Missouri permit some amount of cultivation to the base of the Rocky Mountains, and to 47½° of latitude. On the west of these mountains it re-appears in the same latitude, and in the lower valleys of the north fork of the Columbia it goes to Fort Colville, near 49° of latitude. This is another extreme point of range, and though much the larger portion of this great elevated interior, southward to New Mexico, admits but a partial and imperfect cultivation, the climatic range is interesting at least. At 120° of longitude, the growth ceases for all latitudes on this continent, but between 97° and 120°, the whole continent is embraced south of the points just named, in its range of growth, except the Rocky Mountains and the plateau north of New Mexico.

A brief reference to the European range will show the measure of contrast between the two continents in this respect. Africa is so entirely tropical that it has little place for Indian corn, though it is cultivated to some extent near the Mediterranean.

In Europe, Spain, a small part of the south of France, Italy, the valleys of Austria, Hungary and Turkey, with the islands of the Mediterranean, comprise its range. In almost all these districts it is also quite subordinate to other staples, though imperfect cultivation may be one reason of this inferiority. Over the more densely populated and valuable portions of Europe, it scarcely grows at all; and the little grown in France, north of the mountains, and in Germany, Austria and Russia, scarcely gives it any importance. The single element of greater heat for one month of the summer is wanting; and so precise and imperative is the requirement, in this respect, that no skill seems likely to acclimatize Indian corn in the more important European countries just named, and in the British Islands. From a table of mean temperatures for the various stations named above, it appears that this cereal is suscep-

tible of cultivation at any point where the mean temperature of the month of July is not less than 64° Fah.

The observations upon which the above facts are compiled, were made principally by military commanders and missionaries, at the outposts of the North, during a period, ranging from one to twenty-one years.

The corn plant or its grain formed the subject of very imposing ceremonies among the Indians, and the "corn dance," at the time it came into its roasting-ear state, was looked forward to by both young and old as the foreruner of fun and frolic, with the belles of the wood, the aged for its more solid uses, as it then formed the great and nearly only luxury of the Indian. Although much has been written to prove its Eastern origin, it did not grow in that part of Asia traversed by Alexander the Great, as Nearhus the commander of the fleet has left a work giving the names of all the productions of the country, and describing them. Corn is not of the number. Nor is there any account of it among the works of any of the ancient authors. In fact, until Columbus discovered America, it had never entered the annals of the historian. But in America it was not only found in cultivation, but it was subsequently found growing wild all along the foot of the Rocky Mountain range, though here each grain was clothed in a separate husk which, however, it looses, in a few years, by cultivation. Nor was its cultivation confined by any means to North America, for La Vega tells us that one of the Incas of Peru had a miniature garden at his palace in which was maize of some size, and in quantity sufficient to represent a field made entirely of silver and gold, and that it had the grain, leaves, and even the tassels all complete, as in the natural state; an evidence of the veneration of this people for this cereal.

Among Europeans the "London Colonists," on James River, have the credit of its first cultivation in 1608. They were taught by the Indians, and with some improvement in

implements this plan is still pursued by all the planters of the United States.

The yield in the Virginia soil is said to have been immense—more than a thousand fold, far more than is ever raised at this day. In 1609 the first regular field, consisting of forty acres, was planted by these colonists on James River, and these bold pioneers of the new world first felt themselves secure from famine.

In 1621 two Indian chiefs, Somoset and Squanto, visited the Pilgrims at Plymouth, and greatly to the dissatisfaction of the other Indians, taught them how to prepare the soil and plant the corn. They also planted peas and barley, the seed of which they had brought over with them. They placed in each hill of corn an alewife, a species of herring, as manure. The corn did so well that samples of it were sent to England, but the barley and the peas failed. The same year Stephen Hopkins and Edward Winslow went to the the village of Namasket, situated where Middleborough now stands, and they were received with great hospitality by the Indians, who instituted feasts in their honor, the principal constituents of which was corn bread, which they called *mazinne*, whence the specific name *maize*, which with venison steaks and shad formed a very savory meal to the half starved emigrants. In 1629 the settlers raised, on the Maseachusetts Bay large crops, which yielded about five hundred fold. Thirteen gallons of seed planted yielded three hundred and sixty-four bushels in one field, which at the present rate of planting would give about fifty-six bushels of corn to the acre. This was a very fair crop, but not so good as that of the Virginia colonists, who more than doubled the amount. But in the early settlement of Illinois, on the bottoms and rich prairie lands, the yield often equalled that of the London colonists.

It may be interesting to know the value of this cereal in that early day, and from a price list before us we see that in 1630 corn sold in Massachusetts Bay at 10s. per bushel,

($2 50); in New Netherland in 1650, 10 to 15 stivers per skepel, (15 to 20 cts. per bushel); in Virginia in 1821, 2s. and 6d., (62 cts.) per bushel; in Rhode Island in 1670, 25 cts. per bushel, and on the Piscataqua 75 cents per bushel. Taking the value of money at that early day, as compared with the present, these prices would be equal to about four times our currency. Since that day the price has fluctuated with the supply. There is always a demand for all that may be produced, but the seasons sometimes are so unpropitious that partial failures in sections create a brisk trade, and full prices in that section. Formerly these failures entailed great distress on account of the difficulty of transportation, but the rail-roads have, to a great extent, obviated that difficulty. We all remember the drought of 1854, when nearly the whole crop, except on the river bottoms, was a total failure, and then corn was in great demand, at from $1 50 to $2 00 per bushel. In 1874 another drought rendered it necessary for much of our supply to be brought from the Western States, but it was freely sold at $1 00 per bushel. A total failure of this important crop would entail a degree of distress on the United States incalculable, but there is such a diversity of climate and soil, and its cultivation is so universal that a general drought will not in all probability ever take place, and the whole country being intersected and threaded by rail-roads, the facility of quickly supplying any deficiency at any point will always save, at least, a famine for man or beast.

VARIETIES.

When first discovered in America there was but one variety known. But since that time, its importance has stimulated experiments, with the view of improvement, and the result is that the species has been divided into innumerable varieties. These modifications are the result of differences in soil, cultivation, and climate, and subsequent hybridizing. Many of these varieties are suitable to the section in

which they originated, and though making enormous yields there, carried to a warmer or colder climate, they do not fulfill the promise that seemed so fair. I have seen the finest, largest, premium corn brought from the prairies of Illinois, and planted in rich land in this State, with the expectation of good crops, yet the yield so far from being good, was astonishingly small. It may be set down as a rule that the best plan is to select the good corn of the State or county and improve on that by cultivation. For instance—a farmer in Rutherford, many years ago, began with the white cob gourd seed corn, that had from twelve to fourteen rows of grains, and by prudent selections and close attention, in a few years he brought it up to 34 and 36 rows of grains to the ear, with a cob three inches in diameter, and this specimen will shell out a bushel of grain to fifty ears.

As a general thing, the names of the different varieties are taken from the originator or some fancied resemblance, and so that in two sections the same corn will be known by different names. Some that have acquired a general reputation have a name common to the whole country, and to these we shall have to confine our remarks. The colors of corn are often taken as a distinction, and they depend on the epidermis generally, though sometimes on the oil of the grain. If, however, the epidermis be transparent the color will depend either upon the oil or the combined particles of which the grain is composed. If the hull is opaque of course the color depends entirely on the epidermis. Some corn is rich in a yellow oil, and the hull being transparent, the grain takes the color from the oil. Others have a yellow hull or epidermis, and the grain is white within, yet it receives its color from the external coloring matter.

It is thus with the Golden Sioux, which has a yellow oil all through the grain but a transparent hull, and the White Flint, each taking its color from its oil and starch. But there are others, red, yellow, blue, and white varieties, that are colored by the epidermis alone. As an explanation of

these varying colors would no doubt interest the reader, if he will split a grain of corn longitudinally and let it drop into a solution of blue vitriol, (sulphate of copper), such as is used for soaking wheat, the germ will become green, because the phosphates only exist in the germ, and by the action of the agent on these phosphates, the copper unites with them, and phosphate of copper, which is green, is the result. Or, by dropping it into a solution of the sulphydrate of ammonia, the green will turn a dark olive color, which arises from the change of the salts of iron into a sulphuret of iron.

Thus it is apparent that the color is modified by whatever constituents are found in the soil, and these changes, by constant application, become permanent. Many theories have been evolved in regard to the importance of improving the kinds, and in fact starting new varieties, by selection of seed from the butts, tips and centres of the ear.

In proof of the efficacy of this plan, many elaborate treatises have been written to prove the favorite spot from which to select seed, with, in all cases, very startling results. But Prof. Daniells of the University farm of Wisconsin, an accepted authority on all agricultural subjects, instituted a series sf experiments conducted with great care, and long continued, and having grown corn from each end and the middle, came to the conclusion there was no practical difference.

Among other authors, however, is Dr. Flint, who claims to have seen it tested at the Massachusetts State farm in 1858, with the following result, viz:

Value of crop planted from seed at large end, same number of seed planted in each case, and receiving same treatment and on same soil,

738 pounds of sound corn at 1 cent,.....................	$7 38
77 pounds soft corn at ½ cent,..........................	39
1360 pounds fodder at $7 per ton, ...	4 76
	$12 53

Value of product of rows planted with corn taken from the middle of ear,

663 pounds sound corn, at 1 cent per lb,................	$6 63
164 pounds soft corn; at ½ cent per lb,..................	82
1200 pounds fodder;..	4 51
	$11 96

Value of product of rows planted with grain from small end or tips of the ears,

747 pounds sound corn,....................................	$7 47
53 pounds soft corn,..	27
1320 pounds fodder,...	4 62
	$12 36

He recommends a further trial, though the above was conducted on the fairest principles. However, it proves nothing, and we are inclined to accept the result of Prof. Daniells' experiments.

One thing should be borne in mind in selecting seed, bv those wishing to start a new variety. In the first place, select the seed that is best adapted to the land to be cultivated. Actual experience can only give the true solution as to which is the best. Select in the fall, while the corn is yet on the stalks, large ears, from those stalks only which have two or more ears. Also notice the length of the butt of the shuck, and get ears with short stems. And lastly, get ears that grow low on the stalk. Do this for a few years judiciously, and every man can have a variety of his own.

The varieties are innumerable from this very reason, and while it is impossible to collect all the names, it is equally unnecessary to do so. But there are some of national celebrity, chiefly made so through the dessemination of

seeds by the Patent Office or Agricultural Bureau at Washington.

Among these are, 1st, the "Wild Corn," of the Rocky Mountains, with husk to every grain; 2d, "Early Canada;" 3rd, "Improved King Philip or Brown Corn;" 4th, "Golden Sioux;" 5th, "Tuscarora;" 6th, "New Mexican or Black Corn;" 6th, "Stowells Evergreen;" 8th, "White Gourd Seed;" 9th, "Mexican White Flint;" 10th, "Yellow Gourd Seed;" 11th, "Shoepeg;" 12th, "Eight-rowed Yellow;" 13th, "Twelve-rowed Button;" 14th, "Golden Flint;" 15th, "Sweet or Sugar Corn;" 16th, Adams' Early;" 17th, Runners' White;" 18th, "Cooley's White;" 19th, "Kentucky Field;" 20th, "Wyandotte Gourd Seed;" with many others, and last and least, but important, "Pop Corn" of which there are also several varieties, and the smallest and perhaps the best is Dixie Corn.

Prof. A. E. Blount, of Cleveland, in this State, has by careful culture and selection, produced an exceedingly prolific variety which is highly commended. I learn from Prof. Blount that he produces over 100 bushels to the acre of this corn, sometimes as many as six and eight ears growing upon one stalk.

In effect we have two general varieties, the "White" and the "Yellow," and these are sub-divided into the "Flint" and "Gourd Seed." All the balance are modified forms of these. Of course this division excludes Pop corn, which is nothing more than the *petit* grandchild of the wild corn.

Many of the above named varieties have been sent out by the "Agricultural Bureau," and their qualities have been tested all over the country, and the results, always enormous, given to the country in the "Reports." That these seeds have produced fine crops, is mainly due to the method of cultivation, being sent out in minute packages, they received extra attention.

The practical conclusion of all these experiments is, that f we want good bread, we plant the "White Flint;" if

good stock corn, the "White Gourd Seed;" while for hogs, the favorite sorts are the "Yellow or Red corn." These kinds have proved themselves to be *the* corn for Tennessee, and whenever the Southern farmer sends north of the Ohio for corn seed, he will be ashamed of his corn field in summer.

It will be seen from the analyses here appended, that there are material differences in the very constituents of these varieties of corn, calculated to adapt them for the very uses to which they are applied. The White corn abounds in starch; and is almost destitute of oil, and so is well suited for bread and hominy; while the yellow corn contains a large proportion of oil, which, as a fat producer, is adapted to the fattening process. Many persons lay great stress on the size and color of the cob, and not without reason. In Middle Tennessee, the "Little red cob," or Willis corn, is a favorite with almost everyone. As a rule this is a gourd seed and the ear is nearly all grain, as the cob is very small, while the grains are very long and have very fine tips, barely touching the cob and crowding outward.

The white cob is generally a flint, and makes excellent bread, giving less bran than the gourd seed, but from the hardness of its grains is not so well suited for horses.

One of these flint varieties is the "Hominy Corn," which, as its name implies, is used almost solely for the manufacture of hominy. The flints are much less apt to injure from exposure to the weather, the gourd seed being more pervious to moisture. The "Yellow" and "Red" are supposed to be more prolific, the ears being larger, the grain heavier, and the stalks more vigorous. The large crops of the country, to be hereafter noticed, are usually Yellow corn.

The subjoined tables of analysis will give a good idea of the composition of the several sorts.

The relative proportions of the constituents of each corn

depend on the appropriating power of each species. For instance, the sweet corns take twice as much of the phosphates from the soil as white flint. Yet, these two have been planted together, and grains of each found on the same ear. Let these grains that grow side by side on the same ear and stalk, that received the same nourishment, be split and immersed in a solution of sulphate of copper, and the green color given indicates more than double the amount of phosphate in the sweet than in the flint.

Take specimens of grains split as before directed and immerse them in tincture of iodine, and the limits of starch and dextrine will be exactly defined, the iodine making an intense blue with the starch, and a port wine color with the dextrine or gum. The horny covering of the grain has so much oil combined with the gluten, its chief element, that it is protected from the action of the re-agents, though, if the oil be extracted by immersing in alcohol, the starch will be seen in this portion also. By these and the before-mentioned experiments, the precise amount of the phosphates, oils, irons, dextrine and starch can be ascertained in each variety, and thus the farmers will be able to apply the precise elements requisite for the formation of the grain.

Now, one of the practical results of the knowledge obtained is, that the more phosphates contained in corn, the more osseous or bony matter supplied to the animal fed with it; hence old animals fed largely on corn are disposed to gout or stiffness, which is produced by the deposits of the superabundance of bony matter in the joints, forming small concretions of phosphate of lime. Every one has noticed about the knees of old horses these knots.

With regard to the relative proportions of starch in the different varieties of corn, it has been observed that the white soft corns contain the most, but contain little or no oil or gluten. The Mexican Black is likewise chiefly composed of starch, while the Yellows have a large proportion

of oil. Pop corn has the least starch of any of the varieties and the most oil.

It will be remarked there is a great difference in the distribution of the oily and glutinous parts of corn. Many of our Southern kinds have it deposited on the sides, while the starch is in the centre and extends to the top of the grain bulging it up in a rounded form, and when the grain becomes dry the starch cells retract, causing the top of the grain to be rough, having little dints or pits in it.

The horny outer covering of the grain is composed largely of oil and gluten, with some starch interspersed. In the process of the fermentation of malt in distilling corn, this oil rises to the surface and is sometimes saved and used for illuminating purposes. As much as 11 per cent of oil is found in some varieties. On this oil depend its keeping qualities, as it retards decomposition. Thus corn, planted, is enabled to preserve, through its oily portions, a sufficient amount of pabulum to support the young plant, until it has time to throw out roots and get its support from the soil. Also meal made of the flinty corns will keep well, its oil preserving it; while the soft corn meal, unless kiln-dried, will soon sour. The abundance of oil makes corn pop. The oil when heated to a certain point becomes suddenly decomposed, and in such a violent manner the cells are ruptured by the sudden expansion of the carburetted hydrogen gas formed by the decomposed oil, and the whole grain is retrofexed on itself.

The proportions of oil in corn varies with the variety, being as much as 11 per cent in some, and becoming less in others, down to none. One hundred bushels of ordinary flint corn will yield fifteen gallons of oil. If corn be placed in lye the oil next the hull forms with lye a soap, which causes the skin to slip off easily, and this is the manner in which lye hominy is made. The lye not only loosens the skin, but acting on the mucilage around the germ liberates that too. Flinty corn meal will not rise

well on account of the oily portion preventing adhesion, and to make it rise there must be added rye, wheat, or barley flour.

It is the presence of this large proportion of oil that makes corn so useful in fattening stock and poultry, as the oil goes, almost without a change, as a deposit into the animal tissues. The starch also, not only contributes to the heat by its slow combustion, but is largely changed into fat, and into the substance of the living frame. Dextrine and sugar are also, by a slight change of composition, passed into the tissues to serve the purposes of heating and building up. The salts of iron are taken up by the blood and it then undergoes oxydation in its passage through the lungs, which continues through the arteries. veins, and their capillaries, thus carrying oxygen to every part of the body. The phosphates contribute to the brain and nerve tissue and to the bones, and more solid portions of the body. Thus, every part of corn has its duties to perform in the body, and it is one of the substances that contain all the elements of nutrition in itself.

For analyses see next page.

ANALYSIS NO. 1.

Pennsylvania Yellow Corn "Gourd Seed."

	Uudried.	Dry.
Moisture	8.87	
Oil	5.17	5.67
Sugar	1.10	1.21
Gum	1.23	1.35
Zein	1.98	2.17
Starch	70 66	77.54
Albuminoids	7.94	8.71
Cellulose	1.72	1.89
Ash	1.33	1.46

ANALYSIS NO. 2.

White Gourd Seed Corn from Maryland.

	Undried.	Dry.
Moisture	8.03	
Oil	5.61	6.10
Sugar	2.45	2.66
Gum	0.97	1.06
Zein	1.45	1.58
Starch	70.36	76.50
Albuminoids	8.36	9.09
Callulose	1.53	1 66
Ash	1.24	1,35

It has always been a matter of wonder with the people North, why the people South live so much on corn bread. The truth is the bread-making qualities of Southern corn are greatly superior to that grown in the Northern States. It is far sweeter, and bread made of it has an entirely different taste and flavor. In one pound of Northern corn there are only 21 grains of sugar, as shown by the subjoined analysis—while the sample analyzed of Southern

corn shows 200 grains. But to compensate for this the Northern corn contains more fat but a smaller quantity of albuminoids.

AVERAGE AMOUNT OF NUTRIMENT IN ONE POUND OF NORTHERN CORN.

Water	2	oz.	105	grs.
Gluten—nitrate	1	"	402	"
Starch } carbonates	9	"	262	"
Sugar } carbonates	0	"	21	"
Fat } carbonates	1	"	101	"
Woody fibre waste	0	"	350	"
Mineral matter—phosphates	0	"	70	"

AVERAGE AMOUNT OF NUTRIMENT IN ONE POUND OF SOUTHERN CORN.

Water	3	oz.	0	grs.
Gluten—nitrate	4	"	215	"
Starch } carbonates	3	"	218	"
Sugar } carbonates	0	"	200	"
Fat } carbonates	0	"	20	"
Woody fibre—waste	1	"	21	"
Gum—waste	0	"	200	"
Mineral matter—phosphates	0	"	250	"

Another comparative analysis of Northern and Southern corn with wheat gives the following result:

	Nitrates.	Carbbonates.	Phosphates.	Water.
Northern corn	14.0	78.9	1.2	5.9
Southern corn	39.5	46.5	4.7	9.3
Wheat	16.9	77.2	1.9	4.0

It will be seen that Southern corn abounds in food for the muscle and brain, being much richer in the nitrates than wheat, but not having so many elements productive of heat.

Considered as a food, corn is probably the cheapest in the world, except such as grows spontaneously. It is possible for an adult to subsist on a bushel of meal a month at a cost of fifty cents or even less, or say twelve bushels a year, costing six dollars. The amount of corn necessary to make this amount of meal can be grown on a fourth of an acre of land, or to put it in another way an average acre of tillable land will grow corn enough to subsist four persons for twelve months, and they would feed as luxuriously as the rice-eating people of India. The capacity of the corn-growing belt of America to sustain a dense population, viewed in this light, is almost uulimited.

A comparison of yellow and white corn shows:

	Flesh-formers.	Fat formers.	Other matters.
Yellow corn contained	9.66	76.93	13.41
White corn contained	9.89	78.42	11.69

It may be observed that these specimens are both "gourd seed." the yellow color being from the epidermis, so there is not the same difference as exists in the yellow corns, whose color originates from the oil.

The cobs of these two varieties were also analyzed, giving remarkable results as to their nutritive properties. A cob of the yellow corn weighing 560 grains when burned, left 7.6 grains of ashes or mineral substances, the rest being organic and principally convertible into living tissues; and a

cob of the white weighing 290 grains when burned left 4 grains. Of this residue there are just such minerals as are contained in the animal tissues. Thus, it may be seen, that the cobs, as well as the grains, take up substances from the soil according to the capability of each variety.

Much judgment must be exercised by persons selecting seed corn. Those living on bottom land, rich in humus, will select any of the large kinds, assured of a crop of good corn, while those living on high elevations, with cool winds and short summers, will select, naturally, those varieties of flints that mature in a short time, and are acclimatized to the cold. Should it be for fattening purposes the oily corns or "yellows" are taken. But at last the farmer can be the best judge of what has done well on his soil, and will, therefore be governed by his experience.

CULTIVATION.

There is scarcely a farmer in the State of Tennessee but has some favorite method of cultivating corn, which he learned by his own, or the experience of his ancestors, and because he has always succeeded well he is satisfied to continue in the beaten path. But as the country thickens in population, land becomes more valuable, and labor cheaper, so if he should keep pace with the times, it should be his endeavor to produce the same surplus as formerly, with less land. This can be done by studying the plant food required, and supplying it in sufficient quantity. Vegetation is very adaptive, and corn planted on poor land, will make corn, though the ears are meagre and the yield sparse. But supply a sufficiency of food to that corn through the same medium of soil and its gluttony becomes amazing, and instead of the diminutive stalks scattered sparsely on the land, behold the great proud plant, spreading its large, green leaves to the breeze, waving its tall, yellow plume on high, and thrusting out its huge aldermanic fruit in the middle. The outlay of manure, quickly returns manifold in the

shape of large, remunerative crops. Thus, it should be the emulation of every farmer to excel. No one is injured by his success, but he is the recepient of all the bounty resulting from his labors.

Any soil in our climate will produce corn, but not all in paying quantities unless specially prepared. The best corn land is the rich, black limestone upland, or the alluvial bottoms. If the land is wet it will be sour and the corn will "french" and no result accrue to the farmer. If possible the land should not be tilled in corn more than one year without rotation, as this is necessary to keep up its fertility. By rotation, the ingredients necessary to produce any crop, will be renewed in the soil by the decomposition of its elements. This matter is treated of more fully under the chapter on manures.

When the field to be planted is determined on it should, in all cases, where practicable, be broken up in the previous fall. By so doing, the weeds will be, to a great extent, destroyed, and the soil will be so mellow and ameliorated, that it will work kindly all the next year, and there will be little trouble in cultivation. Besides the broods of cut worms, those pestilent insects of the farmer, being exposed to the freezes of winter, will be greatly reduced, so that the farmer can plant as early in the spring as the weather will admit, whereas, if it is stubble land, or especially clover sod, the worms will often so effectually thwart the labor of the farmer, that corn need not be planted until the latter part of April. Every farmer in Tennessee knows the good effects of the frosts of winter upon freshly broken earth.

Should it unfortunately be out of the power of the planter to break in the fall, the nearer he can come to it the better, as, if even one frost touches it, good effects will arise.

The soil just before planting should receive all the attention requisite to put it in a thorough state of tilth. Work done at this time is amply repaid in the subsequent culti-

vation. Among other things it should receive harrowing or rolling sufficient to pulverize every clod in the field.

Much difference exists as to the time of planting, some planting early, others late. It will generally be seen that late planting, except in exceptional cases, makes light corn. It is true, it requires less work by probably one plowing, but the difference is more than compensated in lessened yield. All other things being equal, the ground will be ready to plant so soon as nature gives the word, which she unerringly does, by throwing out the flag of dogwood blossoms and redbuds. These signs have been acted on since the Indians taught their observance, and the man who follows this signal will, as a rule, succeed. Some plant with the blossoming of the apple tree, but that is getting late, and he who plants late will, if there is a drought, strike it at the silking time of his corn.

The corn well planted, is half the battle in the crop, indeed the crop may be said to be half made. Let the planter stir the surface every ten days, thinning out to two, and in thin lands to one stalk to the hill.

It was once thought best to stir deeply with every plowing, but experience has proved that the deep culture should be done before planting. The surface roots of corn are the ones that sustain it and make the thrifty plant, and it were better they should not be disturbed at all. But this is inevitable, on account of the germination of weed and grass seeds, and the necessity for a circulation of air through the soil. Three things are requisite for the rapid growth of plants, viz: light, air and moisture, and to afford a constant supply of these necessities a gentle stirring of the surface is necessary. But, at the same time, the fact of the existence of rootlets all over the ground will deter the prudent farmer from going too deep. By keeping the crust broken, air can pass in, giving stimulus to the disintegration of the nutrient elements, the chemical effect of light passes directly to the roots, and a large amount of moisture is absorbed

from the atmosphere by the loose dirt, it acting as a sponge. The corn should be planted as to distance, in accordance with the capacity of the soil. On good ground four feet each way, with two stalks to the hill, will be a good distance, or if drilled, let the drills be four and a half feet apart, and one stalk every eighteen inches in the drill. It is much easier to thin out corn than to replant it. Put plenty of grains in each hill, four or five will not be too many, for should a heavy, beating rain supervene the planting, and the soil is afterward baked by a hot sun, it will require the cumulative force of all the plumules to break through to the surface. With a perfect stand there will be on land checked four feet each way and two stalks left in a hill, 5,444 stalks. Allowing one ear to each stalk and 100 ears to the bushel, fifty-four and a half bushels ought to be the result. Yet, but few farmers even in practise realize on their whole crop this amount. Drilled corn, with a good stand, will not grow so many stalks; but there being only one stalk at a place, the ears will be larger, and the stock will more frequently bear two ears.

The method of planting, is undergoing a change with the acquisition of agricultural implements. Though the usual plan is to plant by hand and cover with a plough, hoe, or drag, still there are many who have adopted one of the many corn-planters. The seed is distributed far more regularly, and uniformity of stands is secured. There are many patented machines, each good in the field, and many better than none. Besides, the labor saved is great, as there are no rows to be laid off and no covering to be done save that effected by the machine. But the farm should be level to use such implements profitably. As to the subsequent cultivation the method of level culture has, of late years, proved so beneficial, that it commends itself to the favorable consideration of every farmer. With a great heap on each side of the corn-rows the plant is deprived, to a great extent, of two of the necessities of healthy growth, light and air. With level culture, this is obviated. Besides, with

level culture, the rootlets are not torn at every plowing, thus arresting for several days the growth of the plant.

Corn should be plowed every ten days at least, and no one should over-crop himself in such a way as to fail to be able to do it. Many implements are used for plowing corn, the bull-tongue, shovel, mold-board, double-shovel, cultivators of various patterns, and last, but not by any means least, the walking cultivator. Any one who has seen the operation of the last-named, will not hesitate to buy one. The corn can be plowed several days sooner than with any other implement, simply because, with a careful plowman, it is impossible to cover it up. Then it sifts just soil enough around the plant to smother any sprouting weeds, and the amount can be regulated at every hill, at the discretion of the plowman. This cultivator can be used until the corn is three feet or more in height, and, if corn is in good condition at that height, it can be "laid by." One man and two horses, with a walking cultivator, will do the work of four men and four horses, and do it better. It is a difficult matter for one man to attend twenty acres of corn by the old plan; with a walking cultivator, one man, after the corn comes up, will easily cultivate forty or fifty acres. But this does not refer to rocky, grubby, or stumpy land, as in such lands the cultivator will be worthless. Lands of that character will have to be cultivated as best they may.

Four or five plowings, under ordinary circumstances, are all that are necessary to produce a crop, and it is then turned over to the kindly influences of the heavens. Without seasons man can do nothing, but he can, by deep and thorough tilth, counteract many unfavorable circumstances. If the land is deeply broken up at the beginning, it will pass the moisture from the surface below to the roots of the corn, and so save it from drowning out. By the same method, much water will be retained in the soil, so, in case of drought, it will rise up as the necessities of the plant may require.

To recapitulate, first, break up well and deeply, subsoiling if necessary, then pulverize thoroughly, and plant in rows four feet apart, or in drills four and a half feet apart, eighteen inches in the drill. Before it comes up, say in five or six days, run over it all with a heavy harrow, and as soon as it is well out of the ground begin with the walking cultivator, or at least with the double-shovel, and run over it every ten days. By this method the young grass and weeds will never get a start, and will never be required to be wrapped up with dirt, as many seem to think is indispensable.

To show the difference between shallow breaking and deep, a list of experiments is here appended, made by Prof. Daniells, of the Wisconsin State Farm. The lots were of the same character and adjoining; but they were clayey with a clay subsoil and rather too wet. The experiments were continued for four years, but the last year the whole land was well drained, which at once changed the result, as shallow plowing had the advantage, until drained. Besides, the shallow-plowed was the highest point, and the deeply-plowed got all its water as well as its own, and so the corn was drowned.

METHOD OF CULTIVATION.	1871 Bushels.	1872 Bushels.	1873 Bushels.	1874 Bushels.
Plowed five inches deep.......	55.4	43.5	53.4	53.0
Plowed twelve inches deep.....	50.6	50.3	52.8	58.1
Plowed eighteen inches deep...	44.9	54.7	51.3	65.3
Plowed and subsoiled 18 inches.	52.2	56.8	51.1	60.8

It will be seen from these experiments, that draining the soil, worked a wonderful effect in the production.

The Superintendent of the Kansas Farm reports an experiment on 2.95 acres on the prairie which had been enclosed in pasture for a few years, and from which he had cut less than a third of a ton of hay the previous year. The field was divided into six plats, varying in size from one-

third to two-thirds of an acre. Plats 4, 5 and 6 received a dressing of fresh stable manure, applied in winter and spring, before planting. Plats 1 and 6 were broken up in the usual way, two to three inches deep. Plats 2 and 5 were trench-plowed in addition to this breaking, that is to say, a common turning plow followed the breaker and threw about four inches of soil over the inverted sod. Plats 3 and 4 in addition to the plowing received by plats 2 and 5, were also subsoiled, the subsoiler following the trenching plow and loosing the soil to the depth of ten to fifteen inches. The land was harrowed and planted immediately with yellow corn. Cultivators were run through the rows during the season to keep the surface open. The season was an unusually unfavorable one. Corn stood the drought well, and was cut and shocked in September and husked in October, both grain and stalks being very dry.

The following table gives the result in shelled corn:

Plats.	PREPARATION OF SOIL.	Hard corn.	Soft corn.	Total.	Pounds of stalks per acre.
1	Common breaking alone................	5.68	1.86	7.54	1,000
2	Common breaking and trenching........	6.94	2.73	9.67	1,405
3	Same as plat 2 and subsoiled...........	12.24	1.14	13.38	1,656
4	Same as 3, with manure.................	16.48	.76	17.24	1,224
5	Same as 2, with manure.................	14.84	.43	15.28	1,816
6	Same as 1, with manure.................	9.11	.81	9.92	1,026

One well marked difference is, the soft corn is reduced and the amount of stalks increased on the manured.

Mr. John W. Murray, of Carroll county, Maryland, reports in the Agricultural Report of U. S., that in 1873 he raised thirty and a half barrels (152½ bushels) of shelled corn per acre. The lot was below the road and the barnyard, and received the washings from both, and had been in grass for fifteen years. In 1872, he broke and put it in corn,

and got 26½ barrels per acre that year. The next year he broke it very deeply, harrowed and rolled it. He scattered 300 pounds bone-dust and harrowed it in. He then laid it off in drills thirty-two inches apart and scattered 200 pounds superphosphate in the rows and planted the corn on it, one and two grains, ten inches apart. The corn was "yellow." This was on May 17, and on the 4th of June he found the corn did not come up well, so he dragged and replanted, and on the 10th, still with many missing hills, he plowed it.

On 17th, plowed, hoed and plastered weak spots. On 30th, dragged, plowed and thinned. On 4th July, hilled with a potatoe plow, and occasionally thinned where corn showed weak until it began to silk.

These experiments are copied simply to show what can be effected by scientific attention to the production, and we leave it to the intelligent reader, especially that class who are in the habit of renting, if it is not better to rent five acres and put on it the expense usually given to twenty, if the returns will be the same or more? Land at $5 per acre would give a sum at least of the difference rented, making seventy-five dollars; this sum, or a portion, expended on manures and applied would, with a little extra work, make the five acres more than equal to the twenty. And then the proud satisfaction of having the best corn in the country would be a laudable ambition dear to any man's heart.

Before leaving this subject let the necessity of close, heavy and inexorable thinning be impressed on every one. No one can be a judge of the necessity like the farmer. After he has once thinned his corn, if he sees any of the stalks showing signs of distress go into it again and again. If not thinned there will be a certain failure, as many men will find to their cost who wanted to make large yields and did not use judgment in thinning out.

Corn should not be gathered until several frosts have

fallen on it to check all flow of moisture. If put up at all damp it will injure by heating and moulding. Much corn is lost every year by garnering too early. Many cut it and leave it in the fields to dry, and of course it will dry sufficiently here if left long enough. By pursuing the latter plan, much valuable fodder is saved for stock; for after it is shocked it is husked in the field, leaving the stalks, shucks, and fodder for the cattle. This fed in the rough, or passed through a cutter will amply repay the labor of saving it.

Taken at the right time there is no part of the corn but what is nutritious. The stalks are full of pith that are rich in sugar, the shucks and fodder, while not being quite equal to the best English hay, are better than any other of the rough feeds, and the quantity from an acre is enormous. Below is an analysis of the stalk, shucks and fodder, in short just as it is usually cut and shocked, and to show its relative value, I have added the analysis of pea vines and the best thoroughly dried English hay and wheat bran.

COMPOSITION.	Stalks, Fodder, Shucks.	Average of Hay.	Wheat Bran.	Pea Vines.
Flesh forming principles	8.200	10.34	18.00	16.38
Heat and fat producing matters	55.275	43.80	69.00	33.86
Woody fibre	50.251	37.18	....	25.84
Mineral matters	....	8.68	....	9.45
Water	6.276	....	13.00	14.47

This table shows, not only the valuable character of the substances that are usually wasted and burned on the field, but it also shows that pea vines, that are rarely saved by any one, are for fattening purposes superior to the best hay.

Many fail to cut corn on account of the trouble, but in no other way can as much feed be saved in the same length

of time. Nor is the corn in the least injured if cut when the grain is soft. There is always enough sap in the stalk to bring the corn to a healthy maturity. The stalks and fodder supply the best provender for cattle during winter, and they can be kept in our climate on this, without other food.

It is a bad plan for a farmer to lose the results of any part of his labor, and by close, rigid economy alone can he succeed.

Should the farmer determine to cut, the time is just as the shuck begins to dry, and yet before the fodder is dead. By taking advantage of this precise time he will save everything, and the corn will extract juice enough from the stalk to fill out every grain, even if it is not yet full. The usual plan is, to cut so as to leave four hills in every tenth row standing, and by bending these together at the top and tying them into an arch, the shock has a foundation to rest against. Many plans are adopted in tying which will suggest themselves to the practical farmer. The stalks should have slope enough to the centre to prevent the shocks from blowing down. When the work of the year is over, the corn is gathered, leaving the shuck on or not. The stalks can then be shocked again. They are now ready for cattle, that may be fed on them in that or any other place, by either cutting them in stalk cutter or throwing them in racks, made temporarily on some poor spot to catch the manure. If cut up and fed at the barn, there will be such a manure heap as will gladden the heart of every good farmer.

It is often difficult to decide whether a sale at the time of gathering is better than later, the small price early being, in the estimation of some, counter-balanced by the shrinkage. We are able to lay before the reader two well authenticated experiments on this subject that may be a guide to any one debating it. One was made by Prof. Daniells, of Wisconsin; and the other by Mr. Shel-

mire, of Pennsylvannia. The latter measured ten bushels, and it weighed 401 pounds, on the 30th of October, 1870, giving an average of 40.1 pounds. The same corn, December 12th, measured ten bushels but only weighed 35.5 lbs. to the bushel showing a loss of weight, by shrinkage, of 11.5 per cent. The corn was shelled at the last mentioned date and showed the weight of the cobs to be 19.7 per cent. of the entire weight of the corn. Weight of one measured bushel of grain, 51.3 lbs, after fanning, 52 lbs; showing a loss by fanning of 1.24 per cent. in weight.

Another test was made by the same gentleman the next year. November 10, 1871, ten measured bushels of ears weighed 399.5 lbs., an average of 39.95 lbs. per bushel. January 2, 1872, the same corn measured ten bushels but only averaged 34.45 lbs. per bushel. Loss of weight 13.8 per cent. On shelling the grain weighed before fanning, there were 260.25 lbs., showing the weight of the cobs to have been 24.4 per cent of the entire corn. After fanning there was a loss of 2.9 per cent. in weight.

PROF. DANIELLS' TEST.

Weighed Oct. 11th one hundred pounds each, and on Dec. 30, these varieties weighed,	Yellow Dent.	Early Yellow Dent.	Cherokee White.	White Australian.
Weight of ears, pounds	97.75	96.50	93.25	93.50
Loss of weight in drying, pr. ct.	2.25	3.50	6.75	6.50
Weight of shelled corn, pounds.	83.50	80 00	74.50	76.25
Weight of cobs, per cent.	14.58	17.09	20.11	18.45

By this experiment the whole field lost in one acre as follows:

	No. of Pounds in a Acre.	Loss of weight in pounds of an acre of corn.	Pounds of cobs in an acre.	Bushels of Shelled corn in an acre.
Yellow Dent	3702	83	527	55·2
Early Yellow Dent	4396	154	726	62.8
Cherokee	3958	267	741	52.6
White Australian	4745	308	818	64.6

Another farmer in Pennsylvania, by accurate weight and measurement, demonstrated that corn in one year would lose in shrinkage, by weight, 19 per cent.; by measurement, 17 per cent., and shelled corn would lose by weight, 17 per cent.

The cost of raising corn is so arbitrary it would be unprofitable to treat of it, were it not for the purpose of showing how the cost of one acre of corn can be very great, and yet give a handsome profit to the planter. This we will do by giving actual verified results.

A New Jersey farmer gives the cost of 22 acres:

Product per acre,....................................36.45 bushels.
Value of corn stalks per acre,....... .... $4 55
Sold corn at 70 cents per bushel, ... 25 51

Total value per acre of crop,...........$30 06

The expense account is for plowing, furrowing, dropping and covering, cultivating, hoeing, cutting, husking, and drawing corn to crib, drawing and stacking, shelling, winnowing, bagging corn and taking to market, wear of implements, and on land, all giving an expense of 39.65 cents per bushel, or $14 42 per acre, leaving a clear profit of $15 54

per acre, besides receiving nearly all the expenses himself, he having done the work.

From a large number of estimates, the average cost of production without manure is $5 50 per acre. Of course this estimate is for ordinary culture without manures. We have added—to show what can be spent in manures with profit—a list of profits and expenses. They are compiled from various agricultural essays and purport to be trustworthy. It will be seen by these reports that the man who uses manure unsparingly, receives ample returns.

J. J. Flint, 3¾ acres, 600 bushels, value $450; fodder and and stalks $124. Total, $574. Expenses, $329 50, *including* $192 *for manure.* Net profit, $244 50, or $65 20 per acre.

Joseph Goodrich, one acre, 111½ bushels corn and two tons roughness. Cost of production, $70 75, including $39 25 for manure. Stable manure, compost, plaster and superphosphate applied.

James Carter, one acre, 111½ bushels corn and three tons roughness. Cost, $49 50 including $27 00 for manure, 18 loads compost, and a small handful of superphosphate in each hill.

William Morris, one acre, 90 5-7 bushels, corn expense $93 58, of which $58 50 is for manure. Plowed half of the land in November, and the other half in April. Results from both pieces just the same. These results from the efiects of manure on corn might be multiplied indefinately, but enough are given to establish the good effect of manures. Still a farmer should not go manure-mad and spend the product of the whole place in manure. Rather let him try to recuperate his land by proper rotation and frequent seeding down to clover. This is, at last, the cheapest, most convenient, and most universal manure in the reach of farmers. Any man who will establish a system of regularity in making a manure heap, will be astonished at the result of a few minutes regular labor each day in build-

ing a large compost heap. Only have a barrow at the barn and let it be the business of one hand, while the others are feeding and currying, to gather with his shovel all the droppings of the stock, both in the stables and barn yard, and roll it to a central point and place it in a covered pen provided for the purpose. In the fall he can add forest leaves, weeds from the fence corners, and occasionally throw over the whole a layer of earth, and by spring he will have a compost heap that will, as far as it can be put on his land, double his crop. And he cannot do better in the spring than to start early enough to draw every corn stalk, left standing, into the barn yard to make manure for the next year. It is only by close attention to these details of farming that a man can derive any benefit or pleasure from country life, for surely, without profit there will be little enjoyment.

The depth of soil over a grain of corn should not be more than one and a half to two inches. If planted very early still less. Corn planted six inches deep will rarely come up, at five inches it will come very sparingly. At one inch corn will come up in seven or eight days with suitable weather, at one and a half inches in nine days, and at two to four inches it will require twelve or eighteen days, in early spring.

A great stimulus was given to the cultivation of corn by the failure of 1874, the average that year per acre being only 20.7 all over the United States. The cultivation of cotton the next year dropped down amazingly, and corn arose. The average per acre the next year was 29.4 bushels, but then the price went from 64.7 cents per bushel, in 1874 to 42 cts. in 1875. So that the increase in breadth being about ten per cent. brought no corresponding increase in value of the entire crop. Tennesse, from having formerly been a large cotton producer, has become a grain State. The proportion of corn to all the crops in the State is 45 per cent., cotton 15 per cent. and other crops 40 per cent.

In 1876 there were 181,842 bales of cotton raised in Tennessee, and four counties, Shelby, Fayette, Haywood and Tipton, raised 73,127 of these, or four-tenths of the whole amount.

It may naturally be expected that corn will, if long continued cultivation takes place, exhaust the land on which it is raised. But it reduces the fertiiity of the soil far less than may be supposed. Many fields are in cultivation in Tennessee that have been put to corn continuously for three quarters of a century, and yet make handsome yields. Corn is the largest production, not only of Tennessee, but of the United States, of any one crop. But, unlike wheat, much of it is returned to the soil. In fact, according to the prevailing method of culture, the land is not put to its full capacity, and much of its growing power is, therefore, in reserve. Besides, the corn is, as a general thing, fed to stock on the place, and therefore is, in some measure, returned to the soil. Wheat, on the contrary, is almost wholly taken from the land, and as a result the cultivation of this cereal is continually tending westward in search of new fields. Should the plan laid down in this work be followed, that is, should the stalks be cut and fed on the farm, and the corn used to fatten the stock of the place there would be no loss whatever, except the actual weight of the stock sold, which would be a small drain on a fertile field. The statistics of the cereal growths of the United States bear out the assertion of the improved value of land put to corn over that put to any other product that is taken entirely off the land. And this increased value is seen in the improvements made on the farms of the corn growing counties. It is said, if a man has a crib full of corn he has all that makes the farmer independent. He has bread, meat and many other luxuries his taste may require, and so well established is this fact it has given rise to the axiom "he is as independent as if he had corn to sell."

IMPLEMENTS FOR CORN RAISING.

The principal implements for cultivating have been incidentally mentioned, and it will only require a recapitulation of them, together with the mention of some economic machines for the preparation of the grain for market or consumption.

The planter about to engage in corn culture, will require good plows, and it will be a great economy in him to provide himself with the best the market affords. There are many good plows put on the market, each possessing intrinsic value, and all far in advance of the plows of twenty-five years ago. A good steel mould-board, three-horse, or large two-horse plow, capable of throwing up the soil to a depth of 10 or 12 inches, is indispensable, and this should be accompanied with a subsoiler. Harrows, rollers, and cultivators come, as a matter of course, for without them the soil could not be put in a good state of tilth. This process is greatly aided by a drag, cheaply made, by attaching three poles eight feet long by two chains, about three feet apart. This drag, on rough or stalky land, will pass over inequalities of the soil, and pulverise the surface better than a brush or harrow. A corn-planter, if the ground is level, should be in every man's possession who intends planting largely. Some of them make the rows, drop the corn, and is so regulated that by pressure of the foot the amount of seed, and the depth of planting is under the control of the driver. The best of them will plant either in drills or checks. A good seat is provided for the driver, and with two good horses he can plant ten or twelve acres in a day.

A walking cultivator is now being used, far in advance in efficency to the sulky cultivator. It has four hoes, all under control of the driver, and adjustible by the will of the laborer. With it four furrows are plowed at once, and a man can plow as many acres in a day as he can lay off rows for in ordinary planting. This implement can also

be used to advantage in plowing in oats, wheat and other small grains, as it can be set to go in any depth desired.

A husker has been invented, but from all reports at our command, it does not fulfil its promise. A husker in connection with a sheller has been used to some extent, but one great disadvantage is that it does not separate the sound and rotten corn, though it is represented to do so by means of a fan attached. A good corn-sheller and a strong straw-cutter will about complete the equipments of the planter. It is surprising how small the quantity of stalks that is rejected by stock when run through the straw-cutter. So much sugar is retained in the pith that only those portions near the butt are left uneaten. When the stalks are cut up the shucks and fodder are all devoured greedily. No man who has attended horses or mules to any extent but has observed the amount of cobs eaten by them. It is necessary for the stomach to be distended to favor digestion, and when stalks are freely supplied they serve this purpose, besides contributing no mean supply of nutrition.

A stalk-cutter has been used to a limited extent, to be driven through the standing stalks, and cut them in short pieces for the benefit of future plowing. I saw one of these in operation in Lake county among the rank stalks doing effective service. Should the planter wish to cook the food for his animals he will require a furnace, with kettles, or a sheet iron box to boil it in, also a mill to grind it into meal. Below we give a series of experiments to determine the relative value of raw and cooked food, and if the farmer after examining this subject, shall determine to adopt the latter method, then he can select the best means of accomplishing that object. Among the implements above named, the double shovel deserves especial mention. To those not able to supply themselves with the walking cultivator, it is invaluable, and lessons the work of the farmer at least one-half. Mr. Thos. H. Bond, of Williamson county, planted a large crop of corn in 1877, and no other plow ever enter-

ed the fields, and he made an average of 60 bushels per acre, over his whole farm. But a man must not expect to cultivate with this, or the cultivator, in the usual slovenly manner of some farmers, that is, wait until driven into the field by the growth of weeds. To get the full benefit of them, he must keep ahead of the weeds and grass. So soon as he sees the ground broning with the minute points of vegetation, then is the time. If he lets them alone until they are one or two inches high, nothing then will do but to "wrap them up" with a turning plow. It must not be said these plows will not do on hillsides. They may be more troublesome to hold there, but so is a bull tongue or a turning plow, but still they are used, and so can the others be made available there. In fact they may be used any where except on very rocky, grubby, or stumpy fields.

USES.

It has been said of the palm that it is the universal plant of the tropics, furnishing every thing required for the comfort of the outer and inner man. While we do not make clothes of maize, I believe we use it for almost every other purpose. In its young and tender age, it makes one of the best forage crops for our horses and cattle, and so soon as the grain gets into the milky state it furnishes our tables with the greatest vegetable luxury of any country. In all its after existence it serves man and animals as food. Good sugar has been made of its tender pith, and the stalks make excellent shingling for out houses, or for houses if so desired. The grain is used in making starch. The plant gives to many all the hay they ever use. There are made from some portion horse collars, foot mats, hats, bonnets, slippers, pipes, potash, stable bedding. And the shucks go into the paper mills and furnish the paper or a portion of it on which the news of the world is sent to the breakfast table; it has lessened the agony of ducks and geese, in taking the place of their feathers in making our beds; in neighbor-

hoods remote from railroads it furnishes a cheap and excellent article of fuel; oil is distilled from it to light up the houses; whiskey to sicken the well and to cure the sick; alcohol, without which the druggist would be disarmed, comes from this precious grain. Beer, malt, and various other cooling and medicinal preparations, take the place of milk, and the foreign adulterated poisons under the names of wine and ales. Even the cobs are of important use in the manufacture of vinegar and in the making of pipes. The tassels give a fine addition to the vases that adorn our rooms.

It is cooked in more ways than any other food. It is parched and in this way is extensively used by travelers in India and other Eastern countries. It is cooked, when green, on the cob by boiling, or baking, or roasting, or is cut of and fried or made into the most delicious puddings. Cracked and deprived of its siliceous coating when dry, it makes the hominy of commerce. Deprived of its coating by lye, and left in whole grain, it makes lye hominy. Crushed into angular particles, resembling in size and shape gunpowder, it becomes grits. Ground up finer it makes the meal that is used by the people of half the continent of North America, making the corn cakes, batter cakes, hoe cake, johnny cake, ash cake and mush of the Southern States; the tortilla of the Mexican, the stirabout of Ireland and the Polenta of the Italians.

The Kaffirs have recently substituted maize in the place of millet as food, and its consumption in Great Britian and on the continent is increasing every year. The large proportion of carbonaceous substances which it contain makes it more stimulating than wheat. As a food it is not so palatable as wheat, but its possibilities are far in excess, and for cheapness there is much in favor of maize.

We all remember when, in 1846, the famine devastated Ireland by the potatoe rot, maize rushed to the rescue and saved millions of people from starvation. Even now, some philanthropists are trying to introduce it into general use

in Europe, to prevent, as it will, those periodical famines that, with their awful lieutenant pestilence, stalk so regularly over the older continents. Where maize grows there can never be a famine, as it supplies within itself all that is requisite to make man or animal. By its use we are able to sell meats at five or six cents, that a poor man in Europe never sees, and can only be bought at from fifteen to twenty cents per pound.

Hog and hominy was the entire dish of the pioneer, the source of hospitality of the backwoodsman. It gave life to the wilds of America. Its delicious morsels are yet the pride of the palate.

Nor does corn keep its sweetness to itself, but through the aid of bees it stores for man's use tons of honey. And when stung by the aphides its very tears are honey dew, thus, in its destruction, holding out a dying gift to man.

Without corn, the discovery of Columbus would have been long in benefitting mankind. The settlers could scarcely live with the meagre assistance afforded from Europe, and many of them starved as it was. Tennessee certainly could not so soon have had the population it did, for our forefathers, profiting by the example set by the Indians, would parch a bag of corn, and with this bar to hunger fearlessly cross the mountains into an uninhabited region, where they could not by any means, except by the slaughter of wild animals, have subsisted otherwise.

A war party of Indians will not hesitate to undertake a long and dangerous journey into an enemy's country, and endure hardships unknown to us, swimming rivers, climbing mountains, making journeys of wondrous distances, and yet their whole subsistance is a small bag of parched corn, crushed between two stones.

Corn is undoubtedly fed too lavishly to horses. It is very rich in carbonaceous substances, its heat producing compounds being about 70 per cent. of its composition, and consequently creating great heat in the animal.

The subject of cooked or uncooked food has engaged the attention of agriculturists time out of mind, and it is yet an unsettled question. Those who have tried cooked food invariably testify to its worth, yet the trouble of carrying it out deters, and will deter, the many from its attempt. Its advantages are so marked that it is to be hoped it will become the general practice of the country.

S. H. Clay, of Bourbon City, Kentucky, fed hogs with corn in the ear, boiled corn and boiled meal. After fully testing it he calculated that,

			lbs.	oz.
One bushel corn in the ear	made of	pork	5	10
" boiled corn	"	"	14	7
" boiled meal	"	"	16	7
" another case of meal	"	"	18	0

Prof. Mapes, of New Jersey, after numerous experiments, decided that thirteen pounds of cooked meal was equivalent to thirty pounds corn raw.

But then the question comes up as to whether the fuel and other expense attending the cooking will not overbalance the surplus pork. That is a question to be decided only by investigation.

In 1854, the corn crop of Middle Tennessee was almost a total failure. A gentleman in Davidson County, on the 1st of September cut off a piece of corn and planted turnips. The yield was enormous, and he put up a furnace and boiled a large amount of turnips daily, stirring in about a quart of meal for each hog. He fattened and killed thirty-five hogs as fine as he ever had when corn was plentiful, and that with only about two bushels of meal to the hog.

In feeding one hundred hogs, the superintendent of the Iowa State farm reports that he has saved two-fifths of the grain by grinding it into meal, and feeding it dry, and finds still better results by souring it before feeding, and by steaming it, saved at least one half or over.

Examples, well authenticated, of this kind might be multiplied indefinitely. But enough has been said to show that, all other things being equal, the ground corn, or if possible cooked, will go much further than in its natural state. For this reason still slops, though deprived of much of their nourishing qualities, will fatten hogs or cattle faster than if fed on corn with all its ingredients intact.

Sir Humphry Davy, after numerous experiments, came to the conclusion that wheat contained 95 per cent. of nutritive matter, and corn 77 per cent. Therefore if a bushel of corn is worth 77 cents, a bushel of wheat is worth 95 cents, so far as nutrition is concerned. But when it is remembered that the 23 per cent, of innutritious matter, which constitutes a portion of the maize, is desirable in man for food as "necessary not only to satisfy the craving of hunger, but to promote digestion by the stimulus of distention, which bulk alone can give," it will be understood that the comparative value of corn is even greater than would appear from these analyses.

But the prices of these two grains have never been controlled by their proportions of nutrition. Corn in 1877 could be bought in abundance at 40 to 45 cents per bushel, while wheat brought $1.10 to $1.40, thus showing that however cheap, and however nutritious, the taste of the people impels them largely in favor of flour.

Before closing this part of the subject it will not be irrelevant to say a few words on the subject of preparation of corn for human food. In the first place, corn should never be ground too fine. It will never make as good bread when the cells are all broken, as it then has nothing to retain the gas or steam induced by heat, and so it is heavy. When intended to be made into plain bread, put nothing in it but cold water, and make it up with a large amount, and then put it in an extremely hot oven and let it remain only long enough to brown on the surface. This will make bread to suit the most fastidious taste. Every housewife has ways

of her own for making breads, and properly made, they are all good, but good, plain bread can never be made out of dry dough or with a slow heat.

It is barely necessary to allude to the efficiency of meal as a butter-maker. Fed to cows, one-half gallon twice daily, dry, it will, with hay, bring down the milk in showers, and the butter will be yellow and rich. Many dairymen in the North have fed it alone for weeks without detriment to the milk or condition of the cow, but she should never have more than two quarts at a feed, and it should always be dry, as if wet it will pass at once into the second stomach and not be properly assimilated. Judge Owen, of New York, a large dairyman, testifies to the value of this as a dairy food in extravagant terms in the Agricultural Report of 1868.

AS A HAY AND FORAGE CROP.

It would appear that corn, as a hay and forage crop, belongs more especially to a work devoted to the grasses, and in this respect the people of Tennessee do not appreciate its importance. The dairymen of the North have for years been using it as a green food for their cows in that peculiarly dry time of July and August, after the first pastures have dried out, and before the fall pastures have become green from the latter rains.

We have seen already the vast amount of forage in the form of fodder, tops and stalks, that can be saved from one acre of corn. No one can imagine the amount of waste in this respect every year in our State. Mr. Mechi, the most eminent farmer in England, or the world, estimates every ton of corn fodder, which includes stalks, husks and leaves to be worth ten dollars per ton. He also estimates one ton of fodder to every forty bushels of grain. The total crop of Tennessee in 1876, our last published report, was 54,500,000 bushels, which would make 1,365,500 tons of good fodder, this, at one-half of Mr. Mechi's estimated value would be $6,812,500! How much of this is lost by sheer

waste, we leave to every farmer in the State to tell, comparing the amount, he himself has lost.

There is a numerous class of small farmers and tenants in the State, comprising a majority of the citizen, who do not have the land on which to raise hay. From the peculiar circumstances of their annual lease they cannot sow clover or set a meadow, and yet these men have their horses, cows, and possibly sheep that must be fed as regularly as the animals of the landlord.

Nothing is easier than for these men, instead of belling their stock and letting them browse on a precarious range, to provide an abundance of the very best hay for them This is done by sowing one, two or more acres in corn, according to their necessities. Should they desire to do so, they can raise two crops in the year, provided they will sow as soon as the frost is out of the ground. It only requires about ninety days for corn fodder to mature, and it can be cut some sooner. There are several ways of seeding down, and either one must be adapted to the ground to be sown. After the ground is prepared by breaking, harrowing and rolling, the seed may, on very rich ground, be sown broad-cast, one bushel of seed to the acre. Another plan is to lay off the ground one way and drill in the rows, they being not more than eighteen inches or two feet apart. It should be plowed about twice, and then cut, when the grain that will form on some of the stalks gets in the roasting ear state. Another plan, if the farmer owns a corn drill, is to drill the corn on freshly prepared land about six inches apart. It will soon come up, and prevent, by its shade, the growth of weeds or grass. Cut when in the tassel.

A crop of 40 or 50 tons of green forage is not uncommon on an acre of land, and one farmer writes that he, by a fair calculation, in a drilled piece got 72 tons. Of course from its exceedingly succulent character, both of leaves and stems, it loses greatly, but on fair ground not less than

three or four tons of dry forage is easily obtained. Land sown in corn will not only furnish a large amount of hay, but the fodder, if cut and fed to stock as required, will keep three or four times as many as if the land was turned over to the stock themselves. This plan applies with peculiar force to those owning small parcels of land, to renters, or to persons owning a large town lot. Food of a good character may be grown in sufficient quantity, on a mere town lot to feed a cow or a horse during the entire winter.

There is some difficulty in curing corn fodder properly, as it contains so much water. It should be cut and spread in good weather, or, if possible, let it be put in shocks, stand until cured, and then it must have shelter. This shelter may be provided in various ways, either barns, sheds or stacks.

And immense saving will be made by cutting the whole up in a straw cutter. A farmer who once uses a good straw cutter, not only on stalks, but on hay and all roughness, will never feed without it afterward if he has the industry to do that which his judgment approves.

It has been a desideratum with all far farmers to secure green food for cattle all through the year. In the colder climates this is impossible, from the presence of snow through the long winter. But in the milder climates of the South, and generally in Tennessee, this can be done by sowing rye, barley and wheat, and also by having a winter pasture of blue grass and other grasses. But within the last few years, a plan has been invented in France, by which any man can have the best of green food, almost identical with that cut out of a field, all through the year. It was long known that the pulp of sugar beets left after extracting the sugar, was a very superior food, both for cattle and hogs. Various experiments were instituted by which a plan for its preservation might be devised, and at last it was discovered that if preserved from contact with the atmosphere it would remain a fermented food, and the process of

putrifaction would not set in. In this condition it was as good for food as when first compressed. This beet pulp partakes of the same nature of the still slops of our distillery, only not so rich in nitrogenous qualities. An enterprising farmer conceived the idea that green fodder could be saved in the same manner, and after various experiments, conducted through several years, he evolved the plan called "eusilage." This practice has now become an established plan, not only in France, but in nearly all European countries, and has received a long notice and recommendation from the Commissioner of Agriculture in Washington. We will give the details so that any man can test it to his own satisfaction, and we know no reason why our horses and cows should not be regaled with green food through winter, as well as man with preserved vegetables and fruits, and the principle is the same.

Eusilage embraces principally corn fodder, but is not confined to it, as it has been applied to hay, peas, oats rye, barley and clover. But here is the plan:

A pit is dug from five to seven and a half feet deep, the length of corn fodder say six feet wide and twelve feet long at the top, but only ten feet long at the bottom. The fodder is allowed to lay on the ground after cutting until it wilts, and is then packed evenly and closely in the pit until the pile rises as high above as the pit is deep. During the packing, it must be trodden as firmly down as possible. All the earth that comes from the pit is then thrown on the heap, it having previously been covered with straw. The sides and ends must be sloped so as to carry off all rains and there must be at least three feet of earth on top. This is necessary for the benefit of the pressure, as it will not keep well unless well packed. In the course of a few days the pile will have shrunk to half its original bulk, and it will, in settling, dislocate the surface forming fissures in the soil. This must be noticed closely and the cracks stopped at once, and packed over, as if air gets to the mass, the fer-

mentation that is going on will become putrefaction, and the fodder will be lost. The success depends entirely on the extent of the exclusion of air. Sometimes when the crevices in the soil are not at once stopped the fumes of the alochol may be distinctly detected, showing that fermentation is rapidly going to its next process, putrafaction. One case is noticed where an entire failure took place because the pit was covered with sand, its porosity admitting the air. In the beginning of this process simple pits were made, the sides being nothing more than earth, and they were lined with straw or boards, but since its success has been assured, these pits are lined with brick and hydraulic cement to exclude moisture, as it was found that the fodder coming in contact with the earth was generally mouldy and worthless. For the same reason shelters are erected over them, though if the sides are properly sloped and ditched around, this will be unnecessary. Not only are the various kinds of forage preserved in this way, but all kinds of roots, such as beets, turnips, potatoes, carrots, etc., and apples may be kept. It appears from analyses carefully made that a slight degree of fermentation takes place in the fodder, reducing its water and increasing its azotized and fatty principles. It is greedily devoured by all kinds of stock, and in every respect is equal to the green food as it stood in the fields. The fodder of corn does not change its color or apperance in the least, nor does clover, but other hays take on a slightly brownish tinge. When desired for use it can be taken up and placed in the barn, being careful to take out not more than a weeks supply at a time, unless the weather is freezing cold; and the residue must be carefully covered as before. For this reason some farmers have their pits divided by partitions so that one compartment may be taken up at a time. The reason for sloping the ends of the pit is that equal pressure may be brought to bear on the entire pile, it being ascertained that unless pressure is made on all it will not keep well. Some French writers advocate the

mingling of straw with the fodder, and contend it improve the keeping qualities of the fodder, while the latter imparts a freshness to the straw, making it more palatable.

The following is an analysis of the maize before and after eusilage:

	Green Maize.	Maize converted into eusilage.	Maize and straw mixed in eusilage.	Straw.
Water	81.21	81.28	60.71	14.50
Sugar	0.58	0.15	1.68	......
Azotized matters	1.22	1.24	3.74	4.88
Non-azotized matters	10.40	9.58	14.59	34.52
Fatty matters	0.25	0.36	1.50	1.50
Crude cullulose	4.98	4.91	8.70	35.50
Ashes	1.29	2.25	8.43	9.10
Acid	......	0.23	0.44	......
	100.00	100.00	100.00	100.00

In this case the maize had undergone a good deal of drying in the sun and winds before it had been put in the pit. Therefore there was less difference, or rather no difference, in the moisture. The advantage this form of hay has over the dried hay is the facility of digestion, and its peculiar power in promoting a flow of milk, in fact just the same difference there is between the dry food of winter, and the juicy succulent grasses of summer. It has never to our knowledge been tested in Tennessee, but that it would succeed here as well as in Europe seems probable. It certainly would be an easy way to provide a large supply of green forage. The pits will contain about ten tons each.

STATISTICS OF CORN.

I am indebted to Dr. Edward Young, of the Bureau of statistics, for the necessary data to exhibit the exports of

this great cereal from the early history of the country to the present time. In an article on the early exportation of bread stuffs, contributed by Dr. Young to the American Exporter, he says:

"The first settlers of Virginia in the early years of the 17th century, and of Massachusetts a few years later, as well as those of New York, Pennsylvania, Maryland and other States, were anxious to raise sufficient wheat, maize and other cereals to feed their families, so as to be independent of the mother country as regards food. Many years elapsed before the area of grain crops was sufficiently large, and the richer soils were brought under cultivation to enable producers to raise a surplus sufficient to supply the demand of tropical or semi-tropical countries. The first recorded export of grain from the United States occurred in 1646, when a vessel of 100 tons burden, built at New Haven and probably bound for the Canary Islands, was lost with 70 persons and a cargo of wheat.

In 1678 there was considerable export of flour and bread from New York, chiefly to the West Indies.

In 1682 there was a grist mill at Hoboken, which was owned in New York. Flour and grain were that year mentioned as articles of exports from the eastern section of New Jersey.

The total exports of bread stuffs from all the colonies in 1770, was of bread, flour and meal 458,868 barrels, valued at about $2,862,190; of wheat, 851,240 bushels, and of Indian corn, 578,349 bushels. This amount Lord Sheffield, after the war doubted the capacity of this country to exceed. Up to that time England had usually exported grain, yet had at different times been forced to depend on supplies from the colonies; and her West India possessions were mainly fed from this country. Hence in the traffic with the islands this branch of colonial industry was an exceedingly important one. Of the value of the Provinces to England, in this regard, Mr. Burke, in his speech in 1774, uses the following expressive imagery:

one. Of the value of the Provinces to England, in this regard, Mr. Burke, in his speech in 1774, uses the following expressive imagery:

'For some time past the Old World has been fed from the New. The scarcity you have felt would have been a desolating famine, if this child of your old age, with a true filial piety, with a Roman charity, had not put the full breast of its youthful exuberance to the mouth of its exhausted parent.'"

Dr. Young furnishes me with the following statement, showing the exportation of corn and meal from the United States from 1790 to 1799, and to what countries they were sent:

FISCAL YEARS.	Great Britain.	France.	Spain.	Portugal and Portuguese Islands.	West Indies.	Total to all Countries.
INDIAN CORN.						
1790	98,407	10,350	747,849	468,537	687,481	2,102,137
1791	69,616	5,945	133,535	876,905	540,761	1,713,241
1792	58,888	63,370	381,555	467,001	928,756	1,964,973
1793	600	6,251	104,692	386,243	669,414	1,226,972
1794	15,814	4,000	168,537	494,272	508,303	1,472,700
1795	147,727	513,351	200,293	310,901	683,553	1,935,345
1796	237,504	39,911	11,470	64,814	793,466	1,173,552
1797	3,000	....	17,820	59,450	576,692	804,922
1798	1,618	....	89,614	336,503	693,468	1,218,231
1799	30	....	10,946	350,192	580,368	1,200,492
Total in ten years	633,204	643,178	1,866,311	3,814,818	6,662,262	14,812,565

Statement showing the quantity of Indian corn, and corn meal, exported from the United States during the 21 fiscal years ending September 30, 1820:

Fiscal Years.	Indian Corn.	Corn Meal.
	Bushels.	Bushels.
1800	1,694,327	338,108
1801	1,768,162	919,355
1802	1,633,283	266 816
		Barrels.
1803	2,079,608	133,606
1804	1,944 873	111,327
1805	861,501	116,131
1806	1.064,263	108 342
1807	612,421	136,460
1808	249,532	30,818
1809	522,074	57,260
1810	1,054,252	86,744
Total in 11 years	13,484,296	. ... ..
1811	2,790,850	147,425
1812	2,039,999	90,810
1813	1,486,970	58 521
1814	61,284	26,438
1815	830 516	72,364
1816	1,077,614	89,119
1817	387.454	106,763
1818	1,675,190	120,029
1819	1,086 762	135,271
1820	533,741	146,316
Total in 10 years	11,970,380	993,056

Statement showing the values of exported Indian corn and meal each of the ten years, (ending September 30th,) from 1821 to 1830 inclusive:

Years.	Corn.	Meal.
1821	$ 261,009	$ 345 180
1822	378,427	522,229
1823	453,622	476,867
1824	351,665	384,675
1825	429,906	448,167
1826	384,955	622,366
1827	588,462	434 002
1828	342,824	480.034
1829	478,862	495,673
1830	224,823	372.296
Total for decade	$8 394 645	$4,581,489

During that period the export of wheat amounted to only $181,732, of flour $49,043,089, and of rye, oats and other grain $766,747. The percentage of bread stuffs to total exports was .908; of Indian-meal .860; of flour 9.21.

The values of exported Indian corn and meal for the next decade, from 1831 to 1840 inclusive, were as follows:

Years.	Corn.	Meal.
1831	$ 396,617	$ 595.434
1832	278,740	480,035
1833	337,505	534,309
1834	203,573	491,910
1835	588,276	629,389
1836	103,702	621,560
1837	147,982	763,652
1838	141,992	722 399
1839	141,095	658,421
1840	338 333	705,183
Total for decade	$2,677,815	$6,202,292

For this decade the value of the exports of wheat increased fourteen fold, being $2,554,432. The exports of flour were valued at $56,579,601, and of rye, oats, and other small grain, including pulse for this same period, $900,-928. The percentage of corn to other exports was .303;

of wheat .289; of other grain .102; of corn meal .70; of flour 6.42.

Statement showing the values of exported corn and corn meal from the United States, for the decade ending June 30, 1850. In consequence of the change of the fiscal year, in 1843, from September 30 to June 30, the figures given for that year are for a period of nine months only:

YEARS.	Corn.	Corn Meal
1841	$ 312,954	$ 682,457
1842	345,150	617,817
1843	281,749	454,166
1844	404,008	641,029
1845	411,741	641,552
1846	1,186,663	945,081
1847	14,395,212	4 301,334
1848	3,837,483	1,807,601
1849	7,966,369	1,169,625
1850	3,892,193	760 611
Total for decade	$52,307,184	$12,021,278

The exports of wheat for the same period were valued at $15,641,878; of flour $100,431,897; of other grain and pulse $3,631,784. The percentage of Indian corn to all the other exports from the United States for this decade was 2.95; of corn meal 1.07; of wheat 1.40; of other grain .324; of flour 8.97. It will be observed the exports of Indian corn and meal, for the year 1847, were largely increased. This was due to the famine which prevailed that year in Ireland. Immense quantities of corn and corn meal were sent from this country to the relief of her suffering people.

Statement showing the value of Indian corn exported from the United States for each of the ten fiscal years ending June 30, from 1851 to 1860, inclusive:

	Indian Corn	Meal.
1851	$ 1,762,549	$ 622,866
1852	1,540,225	574,380
1853	1.374,077	709,974
1854	6,074,277	1.002,976
1855	6,961,571	1,237,122
1856	7,622 565	1,175,688
1857	5,184,666	957,791
1858	3 259,039	877,692
1859	1,323,103	994 269
1860	2,399,808	912,075
Total for decade	$37.501.880	$9,064.833

The exports of wheat, same period, amounts to $75,028,-686; rye, oats and other grain, $7,717,102; flour, $180,-143,666; percentage of Indian corn to other exports, 1.62; of wheat, 3.23; of other grain, .332; of corn meal, .390; of flour, 7.76.

Value of exported corn from the United States for each of the ten fiscal years, ending June 30, from 1861 to 1870, inclusive. The Southern ports were excluded during the years 1861, 2, 3, 4 and 5, because of the blockade and civil war.

	Indian Corn	Meal.
1861	$ 6,890,865	$ 692,003
1862	10,387,383	778,344
1863	10,592,704	1,013,279
1864	3,404 398	1,349,765
1865	3,849,758	1,490,928
1866	11,070,395	1,129,484
1867	14,871,092	1,555,585
1868	13,094,036	2,068,430
1869	6,820,719	1.656,273
1870	1,287,574	935,676
Total for decade	$82.268.925	$12,669.760

The exports of wheat for the last decade were valued at $295,938,699; of flour, $225,713,645; of rye flour, $582,-909; of rye, oats and other grain, $16,120,321. The percentage of the value of Indian corn to other exports was 2.60; of corn meal, .400; of wheat, 9.35; of flour, 7.13; of other grain, .509.

Statement showing the value of exports of Indian corn and meal for each of the fiscal years, (ending June 30,) from 1871 to 1878.

	Indian Corn.	Meal.
1871	$ 7,458,997	$ 951,830
1872	23,984,365	1,214,999
1873	23,794,694	1,474,827
1874	24,769,951	1,529,399
1875	24,465,937	1,290,533
1876	33,265,280	1,305,027
1877	41,621,245	1,511,152
1878 to April	37,660,612	1,101,122
Total for eight years, less two months	$217,012,081	$ 10,378,889

Exports of wheat for the same period were valued at $493,076,289. Exports of flour were valued at $181,396,-267.

The amount of corn raised in the United States, and in Tennessee, as taken from the census returns and the reports of the agricultural department, is as follows:

	U. S., bush.	Tenn. bush
1850	592,071,104	52,276,223
1860	838, 92,742	52,089,926
1870	760,944,549	41,343,614
1871	991,898,000	45,900,000
1872	1,092,719,000	46,818,000
1873	932,274,000	42,604,000
1874	850,148,500	31,953,000
1875	1,321,069,000	58,000,000
1876	1,283,827,500	54,500,000

The total quantity of the principal agricultural products of Tennessee, together with their value, will give a little idea of the power of king corn. This table is for 1876, the last issued by the Department of Agriculture at Washington.

	Bushels	Av'age y'ld per acre.	Acres in each crop.	Value per bushel.	Total valuation.
Indian Corn	54,500,000	24.5	2,224,489	.32	$17.440 000
Wheat.....	11,260,000	8.3	1,356 626	.93	10,471,800
Rye.......	355,000	9.	39 444	.92	326,600
Oats.......	5,400,000	17.6	366.818	.39	2,106,000
Barley.....	80,000	18.5	4,324	.90	72,000
Buckwheat.	97,000	16.4	5,914	.83	80,510
Potatoes ...	1,260,000	80.	15.750	.48	604,800
Tobacco, lbs	32,200,000	630.	51,111	. 8	2,576,000
Hay, cwt..	165.000	1.36	121,323	13.56	2,237,400
Total number of acres.........			4,125,799	....	$35,915,110

The following table is from the *American Almanac* recently issued. The prices given are the average prices in New York city for the month of January of each year:

Year.	Corn, Bu.	Wheat, Bu.	Oats, Bu.	Pork, Mess Barrel.	Cotton, Upland, Pound.	Wool, lb.
1825	$ 42	$ 1 01	$ 27½	$ 13 37	$ 14	$ 32⅛
1826	74	90	45½	11 75	13½	34
1827	70	98	56	11 87⅛	9½	25
1828	57	1 15	34	14 12½	9	25
1829	59	1 63	30⅛	12 25	10	22⅛
1830	54	1 04	32	11 50	9⅛	21⅛
1831	58⅛	1 25	31⅛	13 87	10	25
1832	75	1 26¼	50	13 50	8⅛	27⅛
1833	81⅛	1 19	49⅛	13 25	10⅛	32⅛
1834	59⅛	1 06	44	14 50	11	22⅛
1835	74	1 05	40	13 75	16⅛	27⅛
1836	90⅛	1 73	56½	18 25	15	32⅛
1837	1 06	1 77⅛	57	23 50	16	45
1838	86	1 02	42⅛	21 50	11⅛	30
1839	92	1 24⅛	55	23 25	14	38⅛
1840	59⅛	1 06	33⅛	14 25	8⅛	32⅛
1841	52	1 03	52	13 25	9⅛	27⅛
1842	67	1 25	49	9 62⅛	8½	20
1843	59⅛	88⅛	33⅛	8 87⅛	7	19
1844	43	1 00	43	10 12⅛	8	26⅛
1845	51½	1 02⅛	56⅛	9 31⅛	5	29
1846	74	1 31	47⅛	13 56	6½	27
1847	80	1 02⅛	40⅛	10 25	10	23
1848	77	1 25	50⅛	11 00	7⅛	29
1849	64⅛	1 22⅛	41	14 18	6	26
1850	61	1 25	43⅛	11 81	11	31
1851	64¼	1 20	48⅛	12 18	13⅛	34⅛
1852	70⅛	1 09	47⅛	14 68	8	31
1853	68⅛	1 32	51⅛	19 62	9⅛	39
1854	82½	2 04	49⅛	13 43	10	39
1855	1 01	2 57	55⅛	12 62	7	25⅛
1856	93	2 14	46⅛	17 37	9	32
1857	73⅛	1 75	47	19 67	13	35
1858	61	1 37	42⅛	15 75	9	29⅛
1859	80⅛	1 40	50⅛	17 57	11	33
1860	91⅛	1 45	46¼	16 18	11	39
1861	73	1 44	38	16 12	12	32
1862	67	1 38	40⅛	12 25	37	47
1863	75	1 53	70½	14 43	66⅛	68⅛
1864	1 26	1 82⅛	89½	19 87	75	28⅛
1865	1 95	1 85	1 03	35 25	70	55
1866	95⅛	1 87⅛	1 20	29 12	51⅛	70
1867	1 16⅛	3 00	80	19 12	29	60
1868	1 20	2 45	85	21 00	16	48
1869	90	1 70	75	28 00	26	57
1870	1 12	1 30	78	29 75	25⅜	61
1871	80	1 42	75	19 75	15¼	48
1872	78	1 50	54	14 50	20	70
1873	66	1 67	68	13 25	20⅛	70
1874	84	1 65	77	16 50	16⅛	55
1875	97	1 25	65	20 50	14¼	56
1876	71	1 30	59	20 75	13¼	49
1877	59	1 47	55	17 50	12⅛	48

CHAPTER XXIV.

OATS, RICE, RYE.

OATS—*Avena sativa.*

The oat grows in panicles, the calyx being two-seeded; seeds one bearded; flowers and seeds alternate in each calyx conical in shape, the smaller awnless, the larger having a strong bent awn of two colors; the branches of the panicle are erect when green, but bend and droop with weight of seeds as they ripen. The glumes or chaff of seed are nerved, pointed at end, longer than flower, and unequal. The stem is hollow, two to four feet high, and is an annual.

The word oat is derived from the Saxon, and signifies *eat.* Avena is a Latin word, meaning *desire,* and refers to the fondness of stock for it. Sativa means *sown,* and is also a Latin word.

The oat, like wheat and the other small grains, has an origin in antiquity far beyond the ken of man. Pliny speaks of it as a diet for the sick, and in many of the profuse histories it is spoken of as a food for horses. So soon as the continent of America was settled the oat was cultivated, and samples sent back to the old country as an evidence of the prosperity of the colonists. The Virginians did not cultivate it to the same extent as the Pilgrims, nor has it ever reached that degree of

popularity in the South it has in the North. Nor has it ever been exported to the same extent as the other grains, the supply barely furnishing the home demand. In the early and middle ages it formed a chief constituent of the food of man, and even now, in several European countries, it is preferred by many people to any of the cereals. Oat-cake in Scotland is as common as "bakers' bread" with us. Those who eat it claim that it produces long-windedness, and the mountaineer, with his loaf of oat bread, will walk over the steep, broken country of the Highlands with as much facility as an American will over his broad prairies. It is found growing wild in California, and in several of the Pacific islands, but it may have been scattered there by some of the voyagers in their landings for water.

This cereal forms one of the most important of the grains, and is, with the exception of wheat, more generally cultivated than any other. In America it is only raised for stock. It contains more nitrogenous matter and more sugar than corn, but less starch and fat, and where used for food for man it has maintained its popularity through all vicisitudes.

There are numerous varieties of oats, some quite distinct and well marked, while others are nothing more than the ordinary changes produced by good cultivation and climatic influences. The common "black oat," the "white oat," the "Spanish oat," "Chenailles oat," "potato oat," "Hopetown oat," "black Prussian," "great flag," "Cumberland," "white Swedish," "yellow Lithuania," "white Tartarian," "black Tartarian," "black Poland," "late and early Angus," "Egyptian," "Barbary," and an endless list of local names that only result from some particular circumstance of soil or cultivation, are the most common varieties in use.

A few years ago some man professed to have found in a package of seeds received from Norway a few grains of oats, and by manuring well they were grown into a monster oat that sold at fabulous prices, as a distinct variety. In 1788

a gentleman in Cumberland, England, discovered a stalk of oats coming up among some potatoes, and, carefully saving the seed, he originated probably the best variety of oats of that day, and it still maintains its popularity in the North as the Potato oat. Some gentleman visiting the deserted camp of the Choctaws, in Georgia, after their removal, found at their old stables, a few stalks of yellow or red oats. He gathered and sowed them, and gave it the name of "Indian camp oat. This oat is now in the Southern States, and in portions of Tennessee the most popular variety grown, and will make from seventy-five to one hundred bushels per acre. It has such a coarse, strong straw that it will grow without any danger of lodging on the richest bottom lands. The husk is a reddish yellow, very much like the husk of the "golden chaff" wheat. This oat has not come into such general cultivation as it deserves, and it will, ultimately no doubt, attain a great popularity. Many farmers in the Eastern part of Williamson county, sow it regularly, having been introduced by a Mr. P. P. McArthur, a Georgia immigrant. The Potato oat above referred to is very popular in England where it originated, and is almost the only variety grown in Scotland. It is large, plump, rather thick skinned, white grains, double and treble, long straw, and in England commands a higher price than any other. The "Hopetown" is another English variety, originating from one stalk growing among the potato oats in 1824. It was distributed by the Agricultural Bureau from Washington, in 1873.

The yellow oat was also distributed at the same time, and is giving very good satisfaction. The two last are both imported from Scotland.

But the most popular oat of Tennessee is the Black oat. There are, like the White oat, several varieties of this kind. The Prussian, Poland and Spanish, are the best known.

The Egyptian oat, about twenty-five or thirty years ago, attained a great popularity, both from the height of the

straw, and the quantity of seed. It presented a peculiar appearance, from the fact the panicles all drooped to one side, looking like a plume. It was in its full tide of success when the rust made its appearance in Tennessee, complely destroying, for several years, oat culture, and many persons attributed the outbreak of the rust to this variety of oats, and it has not been grown to any extent since. It is a very valuable variety, and well deservers to be restored to popular favor.

The many varieties of oats cultivated in the North, where oat culture is more popular than here, are but little known to Tennessee farmers. And, really, it is of but little consequence, since the modifications of soil, climate and cultivation would soon obliterate any small difference. We have, it may be said, four varieties that answer all the requisites for successful farming. These are Black oat, White oat, Egyptian oat and Red or Yellow oat. Although the Black oat commands the higher price for seed, there are many who will only sow the White oat. The last two named are not sufficiently known to come in the market as favorites.

Besides these, a variety of White Spanish oat has been sown to a very limited extent, as a winter oat. In the South, winter oats are more common than Spring. There is, however, no material difference between the winter and spring varieties, as any of the spring oats can be converted in a few years into winter oats. This is done by sowing any variety wished in the fall, and saving what comes to maturity, and resowing next fall. The first harvest but little will be secured, the next harvest possibly half, and the third or fourth year a full crop will be secured. It would be well to acclimatize several varieties to the winter, as the heads will be heavier, though there is less straw. Besides, they afford a good pasture during the winter.

Although the commercial weight of a bushel of oats is 32 pounds, yet some varieties weigh as much as 40 to 45 pounds. It is claimed that the Potato oat is the heaviest

of any variety. A winter oat, sown for many years past by Mr. Tom Crutchfield, of Chattanooga, furnishes an immense amount of winter pasturage. When I visited his farm, in November, the earth was matted with the rich, rank, dark-green herbage, fifteen inches high, looking like a thrifty wheat field in early May. I am satisfied that the amount of grazing which this crop will furnish until the middle of March, will equal that furnished by the same number of acres of the very best clover. This oat is an annual, hardy as rye, springs up, after being cropped, with more rapidity, and furnishes a larger amount of grazing than wheat, rye, barley, or any other winter grazing grass. It matures earlier than the common oat by ten days, is not attacked by the fly,, and can be seeded at a time when farmers, outside of the tobacco growing districts, have most leisure. By its aid stock may be carried through the winter for one-half what they can be with regular winter feed. I am satisfied that the cost of keeping sheep through the winter, with this oat will not exceed twenty-cents per head, nor a cow more than two dollars.

The yield is as various as the character of soils. Some thin lands will not make more than fifteen bushels per acre, while a good heavy, stiff loam will, with the some variety, yield seventy-five or eighty bushels per acre. The average may fairly be stated at thirty-five bushels on all sorts of lands. One gentleman sowed two acres of land as nearly similar as possible, and with the same cultivation. One acre he left in its natural state, while he sowed one hundred pounds of gypsum or land plaster on the other. On the first he got fifteen bushels of oats, while on the other he obtained sixty-three bushels, nearly fifty bushels the result of one hundred pounds of plaster. There is, prodably, no other crop that responds more promptly to the application of manures, or that better repays good cultivation, while on poor ground, with slovenly culture, it does not yield enough to pay the expenses incurred. With these facts before us it

should be the aim of every farmer to emulate with each other in developing the capacity of the land, and thus will the result bring its own reward.

TIME OF SOWING.

There is no difference of opinion as to the time and manner of sowing. Every one knows that spring oats should be put in the ground as soon as the frosts will permit. If the weather is favorable, in the latter part of January, or as soon thereafter as practicable the land should be prepared and the oats sown. The soil should be deeply broken and thoroughly pulverized and the oats sown broadcast over the field, and then either harrowed in or plowed in with a cultivator. If the seeds are plowed in with a a turning plow many of them do not come up, or if they do come at all, they are too weak and feeble to grow off promptly. A bull-tongue is used by some, and while this is very good for the oats, it is bad for the farmer, as but little progress is made with so small an implement. A double shovel or a walking cultivator is the best plow, provided the farmer wishes to get the seed in deeper than a harrow will do it. But a shovel-tooth harrow will do it quickly, and, I think, more effectively than any other implement The farmer who delays sowing his oats until the latter part of March or in April, will fail to reap those advantages due good labor Occasionally a farmer does sow late, and from favorable seasons makes a good crop, and this circumstance will injure succeeding crops for years, as dilatory men will refer to this success as a criterion, and thus excuse their habit of procrastination. Some may plead the effect of frost on an early crop. This is futile, for although the first blades may be destroyed by a freeze, it does not in the least injure the crop, as oats are the hardiest crop grown on our farms.

While the general opinion is in favor of early sowing, there is not the same observance in the quantity of seed per

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acre. And, right here, our Tennessee farmers differ so widely from the Northern farmer that it is difficult to determine a just means of observance. In all the Northern States from three to five bushels are sown to the acre, while in Tennessee two bushels and a half is the limit of quantity. The man in Tennessee who sows three bushels is considered extravagant. The agent of the State farm in Massachusetts laid off four lots, consisting of one and a half acres each, to establish this fact of quantity of seed per acre. All lots were sown broadcast early in April, equivalent to our February. No. 1 received five bushels per acre; No. 2 had four bushels per acre; No. 3 had three bushels per acre, and No. 4 had two bushels per acre. They were manured with 100 pounds of plaster per acre, spread broadcast, except a strip of one acre running across all the lots, which received no plaster. The oats were cut in three months and threshed about two months afterwards. No. 1 yielded 42 bushels; No. 2, 35 bushels; No. 3, 40 bushels, and No. 4, 26½ bushels. The acre that got no plaster yielded 20½ bushels. The crop was small, the land being unfavorable for oats, and the season bad. Although the experiment was unsatisfactory, yet it will be seen that the lot sown with three bushels did nearly as well as that sown with five; while that receiving two bushels fell off very considerably. But in our quick, hearty soil, three bushels will probably be the best measure to sow, though a less quantity will often make a heavy yield, as many stalks often come from one seed. J. B. McEwen, Esq., of Williamson county, brought in one stool of oats this spring, (1878), that had from one single seed seventy-seven separate stems. This, of course, is unusual, but it is no uncommon thing to see from fifteen to twenty culms from one seed.

In the colder climates of the North, oats will mature much earlier than in Tennessee. This is due to the short summers, there vegetation seeming to be aware of the necessity of escaping the destructive effects of frost. Oats

there will be ready for the sickle generally in ninety days, while here it requires, if sown early, one hundred and twenty days. It is true, late sown oats will hurry up to escape the heat, as Northern oats do to escape the cold. Thus, oats sown in the middle or last of April, will be ready for the harvest as soon as those sown in February, but the early oats will weigh more to the bushel and will yield far more to the acre. Oats should be cut early or late, as the crop may be desired for food or seed. If for the latter, they should be allowed to fully ripen, but if it is the intention to feed to stock, the oats should be cut as soon the stem begins to turn yellow just below the head, and while the foliage is yet green. At this time the grain is in the dough state, and the stalk and leaves are yet full of saccharine matters, and in this condition the straw will make excellent hay, far superior to corn fodder, and but little inferior to the best English hay, as will be seen by the analyses here appended. Another reason is that in harvesting, if the grain becomes fully matured, much of it will be lost by shattering in the many handlings it must receive before finally garnered.

The manner of cutting is either by reapers or by cradles. This is a matter of taste or convenience to the farmer, and is of little consequence. But it must be borne in mind that all the juices remaining in the stem are of a soluble nature, and the stem, after drying, is very porous, so that if allowed to get wet the nutritive qualities are washed out. So then, in view of this fact, great care must be observed in properly shocking. Some bundles are, of course, exposed to the weather, but let there be as few as possible. The best manner is to make hand stacks, sloping the bundles in such a manner as to shed the rain from the heads to the stubs. Each stack contains about one hundred bundles and tapers to a point, which is neatly capped, and the cap tied. In this way but a small proportion of the straw will get wet, and none of the grain heads. As soon as the oats

are properly cured, say in a week of sunny weather, they will be ready to house, and no delay should take place in this. But there are many small farmers and improvident ones who have no shelter, consequently they must resort to stacks. It is not every man who can stack oats so as to preserve them from the weather. If carelessly done the oats will be a total loss. If properly done they will keep an indefinite length of time. Attention to the following necessity is all that is required to make a good stack, viz: *Keep the heads of the bundles higher than the butts.* This is easily done if the stacker will only bear it constantly in mind to elevate the heads. This can be easily done by occasionally laying a bundle under the upper head. At the same time be careful not to give it so much pitch that the superincumbent pressure will force out the bundles and let the stack tumble

In the countries where oats form a large part of the regular crops, it is the universal practice to thresh the oats before feeding them, and then feed by measurement. In the South however we have adopted the very slovenly and wasteful habit of feeding in the bundles. It is true some are careful enough to pass the bundles through a straw cutter, but the largest number will simply throw a bundle loosely in the manger or rack.

If the bundles are cut up finely they will be eaten, straw and all; and this is a good plan, for the seeds are in this way dispersed all through the straw, and the horse, in seeking the grain, is perforce obliged to take all. Our more careful neighbors however will cut the straw, mixed with a modicum of good hay or bran, and then pour the grain, either whole or crushed, over the mass and their horses are kept in the best order without the use of corn, or at least with a very small quantity of corn, beans or peas.

Some farmers pass oats and barley through the thresher together, and the grain mixed is a very excellent stock

food. It brightens the hair, promotes digestion and gives a horse good health under heavy tasks. For many years it was the habit of farmers to only thresh out oats enough to serve as seed, and they looked at the resulting straw as waste, most of it going to the stables as bedding, or left to rot where threshed. We give below an analysis of the straw as well as of the grain to show the loss they have sustained.

Oats, both green and matured, form a most excellent food for hogs. Nothing will start hogs to fatten more kindly than to be turned on an oat field when the oats are half grown. In a few days they will begin to look smooth, the hair gets sleek and by the time they have been on it two or three weeks they are almost fat. If a large apple or peach orchard is on the farm it will be a good plan to sow it in oats, and as the young apples or peaches begin to fall they, as well as the oats, are devoured by the swine, and thus, not only are the animals benefited but the eggs of insects that are in the fallen fruit are destroyed. In this way in a few years the curculio may be entirely eradicated from the orchards, as well as the borer and other insects injurious to the trees.

We give, first, an analysis of the grain and then of the straw.

Oats contain, starch, 60.54; gluten and other azotized matters, 14.39; dextrine, glucose, etc., 9.25; fatty matters, 5.50; cellulose, 7.06; mineral matters, 3.25: or, economically,

Flesh forming principles,	18.447
Heat producing principles,	73.376
Fat producing principles,	8.178

Wolff and Knopps analysis may be seen on page 336, (under buckwheat).

According to the estimates of Meyer, based upon actual experiments in feeding, one hundred and fifty lbs. of oat

straw are equivalent to 100 lbs. of good English hay, or 65 lbs. of the grain of barley, or 60 lbs. oats, 58 lbs. rye, or 55 lbs. of wheat; and Thaer places the estimate still greater.

Bouissingault gives, for the green oat straw, water, 82.0; starch, 5.0; woody fibre, 7.5; sugar, 3.5; albumen, 1.0; fatty matter, 0,5; and mineral matter, 0.5.

It has been remarked before, that but little of this crop is ever exported. On the contrary, in the year 1851, 679,812 bushels of oats were imported, and also 302,400 bushels of oatmeal. In 1858, this amount had decreased to 115 bushels oats, and 106,288 bushels oatmeal.

In the year 1875, there were exported 504,770 bushels oats; and in 1876, 1,466,228 bushels. This however forms but a small portion of the crop, for in 1876 there were raised in the United States, 320,884,000 bushels.

In 1876, there were raised in the State of Tennessee, 5,400,000 hushels on 306,818 acres, averaging 17.6 bushels per acre, and the average price was 39 cents, making the value of the crop $2,106,000.

I have not deemed it necessary to speak of the Barbary oat, which is a two awned oat, growing on the deserts of Asia and Africa. The long twisted awns or beards are so sensitive to moisture, that they will work like an insect under the influence of the weather, forming a poor hygrometer. They were once sold as barometers all over the country, the awns being affixed to a index.

RICE.---(*Oryza sativa.*)

This grass has a long panicle, resembling, when ripe oats, the seed growing from a short pedicel starting from a central stalk. Each kernal has an awn, glumes yellow. The stem is short, pointed, hollow and about three feet high. It is an annual.

Rice is a native of Asia, but was brought from the Island of Madagascar to Charleston, South Carolina, and was first grown by Landgrave Smith in that city. The white

rice was first introduced, but afterwards the golden seed superseded it, and that is now universally grown both in the swamps and uplands of the South, and is the same as that grown in China and Asia. It is used as human food by more people than any other cereal, feeding it is said, to the exclusion of other cereals, over half the inhabitants. It is really a water plant, and thrives best when supplied with an abundance of it. In fact, to be grown in its best style it is flooded the greater part of the time by means of banks, levees and flood-gates. It may be assumed than it has no place in a Tennessee work, but there are several varieties of rice, and we all remember, in the days of slavery, that many negroes owned little rice patches, where they were accustomed to grow rice and beat it out in a hominy mortar and hawk in the country.

There is an upland or mountain rice which grows well on any rich soil, especially, however, if it is a marshy bottom. I once sowed rice in a seed millet patch, having only a few grains, and it grew very well and made a fair yield. I have seen it yield well in Stewart County. It was for many years grown there by a South Carolinian. All the upland counties of North Alabama, Georgia and Mississippi raise enough for home consumption. It is raised in the germinating gardens in Washington for distribution.

Its method of culture is just as seed millet is raised. It matures about the same time, and should be cut with the sickle just as the millet is. Let it be bound in bundles and stacked. After a week or two it will go through the stack sweat and be ready for cleaning. The husk adheres very closely to the grain, is very tough and difficult to separate. On a regular rice plantation this is done by large stones, but here, in small quantities, it must be done by using warm water and the hominy mortar. It is a tedious process, but like all other processes it can easily be learned by application. It would not pay to raise rice in large quanti-

ties, but nothing is like having a supply of all the good things of life on hand, raised on your own farm. We have become independent of the South, so far as molasses is concerned, let us now raise a home supply of rice, and then, with all the luxuries, as well as the necessities of life, the farmer can snap his fingers at dull care and hard times. From 25 to 40 bushels of rough rice can be raised on an acre, and this will shell out enough to last a long time.

A comparative analysis with other grains will be found on page 336. It is by no means equal to wheat in its nutritive qualities, containing more starch but fewer nitrogenous substances.

RYE---(*Secale cereale*).

Has long bearded ears, and a tall and very slender stem. The glumes are toothed on the edges, has a terminal spike, solitary, erect, from two to four inches long, with beards four or five times the length of glumes. Root fibrous, and annual.

There are two varieties cultivated in Tennessee, besides many others with local names. These two are named from their habits, one being winter rye, the other spring rye, but the former is almost exclusively used.

Rye will grow in a colder climate than wheat or barley, and on poorer soil. On the poorest sandy soils in the State, it will do quite well. It will grow on the Cumberland and Unaka mountains six to eight feet high. Sown in almost any month of the year it will make a crop. Its principal use in Tennessee is for pastures, though some use is made of the grain as meal, as well as for stock food. From the fact that the seeds are rarely saved, the price is, in Tennessee, quite high, as compared with that of other grains, the range of value for several years being as great as wheat.

Among the cereals, rye is cultivated, in Tennessee, least; but in some of the States, it is extensively raised as a distilling grain. It is extensively used in making beer,

and rye whiskey is famous as a beverage the world over. The famous "Hollands" (gin) is made from rye, flavored with juniper berries.

Sown early in the fall, and even in August, it affords a fine nutritious pasturage through the next seven or eight months, or, until it begins to "spindle" up, when it becomes woody, loses its succulent character, and is not relished by stock. In some countries it is sown with wheat, and ground into a meal that is particularly fine and nourishing, and is called *meslin*. It is famous as a healthy bread, suitable for the sick. Rye meal makes breakfast cakes, equal to the best buckwheat, and not easily detected from it. It is used quite extensively among the poorer classes for making coffee, and by dealers as an adulterant for ground coffee.

During rainy wet seasons, a fungous growth makes its appearance in the grains, causing them to be elongated and twisted, forming "*Spurred rye*" or *Ergot*. Men or animals partaking of this diseased grain become poisoned, and the most fatal symptoms ensue, the extremities becoming gangrenous and, if continued in, will finally result in death. Still this ergot is one of our most precious medicines and would be badly missed.

The yield of rye is seldom more than fifteen or twenty bushels to the acre, though, like all cereals, it is greatly benefited by manure. The best manure is bone dust or phosphate of lime, the phosphates entering largely into its composition. The quantity to be sown to the acre is a bushel or a bushel and a half, either for seed or pasturage. It is sown, as other cereals, on well prepared land, though if only wanted for pasture, it is a good plan to sow it broadcast over corn land just before the corn is laid by, and

then plowed in with the last plowing. By the time the corn is gathered, there will be as rich a pasture as may be desired.

Rye has been exported but little, the home consumption being about equal to its production. It forms an important article of diet in Europe and Asia, being mixed with both wheat and barley to make cheap bread. It is supposed to be a native of Candia, and some say of Sicily, as it grows wild on both of these islands. But it is more probable it had its origin, with other cereals, on the slopes of the Himalaya mountains in Asia. It was introduced into Europe after the 15th century, and was brought to America at the same time with the other grains. Its straw is almost worthless as a fodder, stock not relishing it at all; but it is extensively used in the manufactures, as hats, bonnets, mats, paper, slippers, and a great variety of other articles are made from it.

In 1840, the product of the United States was 18,645,567 bushels, and in 1850, it was 14,188,813 bushels; in 1860, 21,101,380 bushels; in 1870, 16,918,795 bushels.

In 1876, there were 355,000 bushels raised in Tennessee, on 39,444 acres of land. being an average of 9 bushels per acre, and the average price that year was 92 cents per bushel. In the United States the same year, there were 20,374,800 bushels, thus giving an increase, in thirty-six years, of less than two million bushels, although the cultivated area of the United States has almost doubled, if not quite. This deficiency may be attributed to the falling off in the demand for distilling purposes. Although so little rye is exported, a considerable quantity of rye meal is taken to Europe.

See comparative analysis, on page 336, (under Buckwheat).

LEGUMINOUS PLANTS.

PART VII.

The introduced clovers, vetches and other vines of modern agriculture have already been fully considered, botanically and economically.

The connection of this family of phœnogamous plants with the economy of agricultural nations, is coeval with the culture of the cereals. Besides the frequent mention made of them in the remotest periods of Biblical literature, we also know from Papyrus rolls and stone engravings of ancient Egypt, several facts relating to them. Lentils, (Ervum Lens,) has been there a favorite dish with the people, and remained so to the present day. On Sculptures servants are represented carrying baskets filled with Indigo, being either tribute or precious merchandise, which came from India. Carobs, or St. John's bread, furnished an important food supply, not only in Egypt, but also in Syria and Palestine. The name Carat is derived from the Carob seeds, serving a standard weight, equal to about 20 grains of wheat, one grain of which was the smallest standard weight then in use for weighing gold and precious stones. Carobs are the fruit of a tree, (Ceratonia Siliqua,) much resembling our honey locust.

Beans (Faba vulgaris) and the Chick pea (Cicer Arietinum) were largely consumed by the lower classes. It is doubtful whether the avoidance of Beans, practiced by the priests, and so strictly forbidden by Pythagoras to his disciples, applies to the leguminous species or the seeds of Nelumbium speciosum, the Water Lily, which then grew abundantly

in the waters of the Nile. Nor could the Egyptian do without his hominy, using Lupines, (Lupinus Thermis) soaked in salt water, like we do Indian corn.

The honey of Hymettus, famous for its flavor, owes its fame in part to the rich fields of clover, that abounded in the pastures of ancient Hellas, and brought from there to Italy, it found gradually its way across the Alps. Following the train of civilization it has long since departed from the parched shores of Salamis and the depauperated fields of Argos, once the feeder of horses

All the cultivated species are indigenous to the Mediterranean region. The Peanut, however, (*Arachis hypogœa*), as palatable to our taste, as its herbage to cattle, is a denizen of two continents, for it is indigenous on the Senegal and in the West India islands. In the warmer climates, under favorable circumstances for ripening, like in India, this nut is very rich in a fine oil which is used there like olive oil, and is said to be even superior. It keeps a long time without becoming rancid. In its more Northern range it produces less oil. An occasion to say more about this curious plant will occur in the botanical description of the Leguminosæ.

A related genus, the *Voandzeia subterranea*, or Bambarra ground nut, of similar habits and like value with the former, is not known in the United States, a native of the Western coast of Africa, and its cultivation is confined to tropical countries.

Very little knowledge of useful leguminous plants has descended to us from the native Indian. The scarcity of bread-giving cereals on one hand and the absence on the Northern continent of those larger animals which are fit for domestication, have rescinded his disposition to cling to a homestead as tiller of the soil; nor could he follow his flocks as a wande ing and peaceable nomade. The abundance of nutritious herbaceous food favoring the multiplication and variation of the less ferocious herbivores, enabled man to gain ascendency and to initiate the most primitive government over submissive, social animals. For these reasons have the Mediterranean regions and Central Asia become the birthplace of civilization, while the North American continent continued to be the hunting domain of the roving Indian. The mild and benign manner of the sheperd and herdsman to notice the wants of the flocks, to distinguish the kinds of food which they would prefer, and to lead

them in regions of plenty, has no parallel in the atrocious character of the Indian, whose only interference with the state of nature consisted in setting fire to woods and prairies, to promote the growth of herbaceous plants and thin the undergrowth to facilitate the chase. The delicious fruits of the warmer regions of the Eastern continent are not met with here, or represented by less palatable kinds and this defect may have produced the unrefined taste of the Indian. Capable of satiating his hunger with a mixture of clay and gum, like the Ottomaks of the Amazon or with tuckahoe, a species of ligneous fungus, resorted to in times of dearths by the Cherokees and other nations, he remained contented with the natural and unimproved offerings of his native land, and attempted to cultivate but few kinds of those—Indian corn beans and tobacco. These Indian beans are several species of phaseolus, growing spontaneously in all portions of the country. Prairie and forest supplied him with several other leguminous plants.

The Screw bean, (*Strombocarpus pubescens*,) the dry and ripe fruit of which is considered a delicious nutriment by the Indians, grows along the Colorado river of Arizona, and the Utahs use it by making bread from the meal of the seeds. All kinds of animals are fond of the pods, and fatten rapidly upon them. Of no less importance are the fruits of the Mesquite (*Algarobia glandulosa*). The pods being 7-9 inches long, are not only nutritious, but also very agreeable, from the combination of a sweet and acid taste, and are a preventive of thirst.

The Pommede prairie is the esculent root of the *Proralea esculenta*, growing in the Northwestern territory, Iowa, Kansas and Nebraska. It is generally the size of a hen's egg, of regular ovoid shape, and the cortical part or skin separates as readily as in a turnip. It has a sweet and turnip-like taste. The Indians of these regions like it very much, and use it extensively in the ripe state. Sliced and dried they store it for winter use.

A rare species of this genus, the *Psoralea subacaulis*, grows abundantly upon the rocky hills and wastes around Nashville. Its short flower-stem terminates a few inches below the surface in a good sized tuberous root, firmly imbedded between the densely packed gravel and rocks This tuber is soft and pleasantly sweet, although growing on the poorest ground, and retains those qualities to an advanced flowering

sta'e. This root has been probably never before observed, and should be tried under cultivation

Farmers know very well that wild and uncultivated lands, mountains and river banks produce a variety of pea-vines which are especially sought after by stock, roaming through the thickets. It has also been very generally noticed, that with the clearing of the land, the multiplication of cattle, and the spread of the root-destroying hog, the former abundance of this kind of forage, that formerly held out in many regions during the whole winter, has gradually grown less. Why this large increase of the herbiverous domestic animals exerts such a deleterious influence upon their number and thins the rank of their species woefully, in locations much exposed to their invasions, is readily understood from an observation of their growth and structure.

Shrubby and arborescent species, worthy of consideration in the present sense, occur only in the lower South and Southeast and all our valuable kinds are herbaceous plants. Some being closely appressed to the soil, others creep over it in wide-spread tangles, some are partly decumbent, few strictly erect, many are trailing and climbing Succulent herbs with a large surface from the development of numerous branches and copious foliage, they dislike exposure to the wind and prefer sheltered situations in forest and thicket; only the creeping varieties like full exposure on the open prairie. Stout stemmed and smooth Baptisias make an exception.

The wiry and stringy rootlets of grasses are securely protected against the tread of heavy animals by an elastic cushion of tuft or sod, but the single and scattered growing pea vines and their congeners possess neither this benefit nor their slender form and elastic structure, and are under a still greater disadvantage from their cumbersome structure, entangling the feet of the animals, and suffering more from tramping and crushing than browsing. Grasses generally live longer as the herbaceous leguminosæ and grass seeds frequently escape destruction by digestion but not so the latter.

The economical value of these herbs depends as much on their abundance as upon nutritious qualities, and it is evident that we ought to prevent their decrease, or even extinction, by trying their cultivation, in collecting their seeds and sowing them either separately or in mixture in

well prepared land. Otherwise those weeds which everywhere follow in the footsteps of the settler, will soon take their place, multiplying with a prodigeous rapidity. The Canada and Common thistle, Amaranths, Door-weeds, Knot-grass, Rag and May weeds and Thorn apples threaten to become the victors in the battle for existence.

List of leguminous plants known to grow spontaneously in Tennessee:

Crotalaria sagittalis, L. Rattlebox, annual July, September.
Lupinus perennis, L. Lupine, perennial. April, May.
Melilotus alba, Lam. Sweet clover. Perennial. May, June.
Trifolium pratense, L Red clover. Perennial. May.
Trifolium arvense, L. Rabbit-foot clover. Annual. May.
Trifolium reflexum, L Buffalo clover. Biennial. May.
Trifolium repens, L. White clover. Perennial. May.
Trifolium Carolinianum, Michx. Carolina clover. Perennial.
Medicago lupulina, L. Black Medic. Annual. May.
Psoralea melilotoides, L. *Psoralea*, perennial. June.
Psoralea subacaulis, Torr & Gray. Perennial. April.
Petalostemon foliosus, Gray. Leafy prairie clover. Perennial. May, June.
Petalostemon decumbens, Gray. Low prairie clover. Perennial. May, June.
Petalostemon corymbosus, Michx. Silky prairie clover. Perennial. June, July.
Amorpha fruticosa, L. Lead plant. June
Robinia pseudacacia, L. Common locust. May.
Robinia viscosa, Vent. Clammy locust, shrub. May
Robinia hispida, L. Rose acacea. Shrub. May.
Wistaria frutescens, D. C. Wistaria climbing shrub. May.
Tephrosia spicata, Torr & Gray. June, July.
Astragalus Tennessiensis, Gray. Tennessee milk vetch. Perennial. April.
Astragalus Canadensis, L. Canada milk vetch. Perennial June.
Vicia micrantha, Nutt. Small flowered vetch. Biennial. March.
Vicia Carolina, Walt. Carolina vetch. Biennial. April.
Vicia Americana, Gray. American vetch Perennial. April.
Stylosanthes elatior, Swartz. Pencil flower. Perennial. June, August.
Lespedeza repens, Torr & Gray. Creeping bush clover. Perennial. June, September.
Lespedeza violacea, Pers. Bush clover. Perennial. June, August.
Lespedeza Stuvei, Nutt Downy bush clover. Perennial. August.

Lespedeza hirta, Ell. Hairy bush clover. Perennial. August, September.

Lespedeza capitata, Michx. Round headed bush clover. Perennial. August, September.

Desmodium pauciflorum, Nutt. Few-flowered tick-trefoil. Perennial. July, September.

Desmodium acuminatum, D. C. Pointed tick-trefoil. Perennial. July, September.

Desmodium nudiflorum, D. C. Crowded-leaved tick-trefoil. Perennial. July, September.

Desmodium cuspidatum, Torr & Gray. Sharp pointed tick-trefoil. July, September.

Desmodium rotundifolium, D. C. Round leaved tick-trefoil. Perennial. July, September.

Desmodium Canadense, D. C. Canadian tick-trefoil. Perennial. July, August.

Desmodium Dillenii, Darl. Dillens tick-trefoil. Perennial. September, October.

Desmodium paniculatum, D. C. Smooth tick-trefoil. Perennial. September.

Desmodium strictum, D. C. Stiff tick-trefoil.

Apios tuberosa, Mœnch. Ground nut. Perennial July, October.

Phaseolus perennis, Walt. Perennial. Kidney bean. July, October.

Phaseolus diversifolius, Pers. Creeping kidney bean. Biennal. July.

Phaseolus helvolus, L. Long-stalked kidney bean. Annual. June, September.

Clitoria Mariana, L. Maryland butter fly pea. Perennial. June, October.

Amphicarpæa monoica, Nutt. Hog-nut pea. Perennial. July, September.

Galactia mollis, Michx. Milk pea. Perennial. July, August.

Galactia glabella, Michx. Small milk pea. Perennial. June, September.

Baptisia tinctoria, R Brown. Wild Indigo. Perennial. June, July.

Baptisia alba, R. Brown. White flowered white indigo. Perennial. July, August.

Baptisia leucantha, Torr & Gray. Smooth wild indigo. Perennial. July, August.

Baptisia australis, R. Brown Blue-flowered wild indigo. Perennial. July.

Thermopsis mollis, R. Brown. Soft-leaved Thermopsis. Perennial. June, July.

Cladrastis tinctoria, Raf. Yellow wood. Tree. May.

Cercis Canadensis, L. Red-bud. Small tree. March.

Cassia Marilandica, L. American senna. Annual. July.

Cassia obtusifolia, wild senna. Annual. July.

Cassia Chamæcrista, L. Partridge pea. Annual. July, August.

Cassia nictitans, L. Sensitive plant. Annual. July, Angust.

Gleditschia triacanthos, L. Honey-locust, tree.

Gleditschia monosperma, Walt. Swamp honey-locust, small tree. May.

Gymnocladus Canadensis, Lam. Kentucky Coffee tree. May.

Acacia Julibrissim. Acacia, tree. May.

Demanthus brachylobus, R. Brown. American Mimosa Perennial. June, July.

Schrankia uncinata, Wild. Sensitive bria-. Perennial. June, August.

Schrankia angustata, Torr & Gray. Narrow leaved sensitive brier. Perennial. July.

Continued botanical research will unquestionably add a good many more species to this list.

CHAPTER XXV.

SHORT MENTION OF LEGUMINOUS PLANTS.

The botanical wealth of this State, so far as we can presently form an opinion, is likely to be greater than that of the Atlantic States, notwithstanding the absence of the littoral flora. A thorough search over the northwestern portions of the State, along the upper course of the Holston and French Broad rivers, would almost necessarily bring forth the whole array of forms peculiar to Western Virginia, Pennsylvania and Eastern Kentucky, and the high summits of the Unaka Mountains, extending over 200 miles in length, are crowned with those alpine beauties, memorials of the glacial period whose aspect and possession is so enchanting to the botanist.

The depressed limestone area of Middle Tennessee is a well defined region in strikingly peculiar effect of landscape, from the conformation of surface and character of vegetation. Between undulating productive lands stretch, rugged cliffs, not cultivable glades, where the cavernous and much fissured rocks lies either bare, or meagerly soil-covered. The cedar with its wide-spreading roots and time-demanding growth, is here at home, and largely in excess of all other timber growth. Pines are not found in those regions known as the cedar barrens, which harbor a number of very rare plants

The western part of the State again, is botanically nearly an unexplored region. As it differs geologically and geographically from the rest of the State, so may also a difference in its flora be looked for. Foremost exposed to the prevailing western currents of the winds, fleeting seeds and germs, wafted over the great plains, arrive there in greatest abundance, and, should even conditions of soil and climate not favor their permanent establishment, they will readily be again replenished. The mighty Mississippi annually overflowing hundreds of square miles, deposits innumerable seeds, whose germs had been fertilized in the distant regions of the far West.

The Leguminosæ are a natural order of the dicotyledenous plants. Herbs, shrubs or trees, with papilionaceous, or sometimes regular flowers 10 (rarely 5, and sometimes many) monadelphous, diadelphous, or rarely distinct stamens, and a single, simple, free pistil becoming a

legume in fruit. Seeds mostly without albumen. Leaves alternate, with stipules, usually compound. One of the sepals inferior (i. e. next the bract,) one of the petals superior (i. e. next the axis of the inflorescence). This order is a large one, being composed of about 550 genera and 7,000 species. It contains a great many useful plants, supplying not only food, but timber, fibres, gums, dyes, and various economical substances. Among the few poisonous plants in their ranks may be mentioned: Two ornamental plants: Coronilla varia and Cytisus Laburnum of Europe. Gompholobium uncinatum of Australia, and Physostygma venenosum, the ordeal bean of Calabar. Of our species the Baptisias are suspicious. The territory between the Mississippi and the Atlantic enumerates 55 genera with about 200 species.

The order is divided in three sub-orders, the first sub-division representing it principally in the temperate regions, the two other belong to warmer climates and tropics nearly exclusively.

Sub-order 1. Papilionaceæ. Proper pulse family. Calyx of five sepals, more or less united, often unequally so. Corolla perigynous (inserted into the base of the calyx) of five irregular petals (or very rarely fewer) imbricated in the bud, more or less distinctly papilionaceous i. e. with the upper odd petal, called the vexillum or standard, larger than the others, and enclosing them in the bud, usually turned backward or spreading; the two lateral ones, called the wings, oblique and exterior to the lower petals, which last are convenient, and commonly more or less coherent by their anterior edges forming a body named the carina or keel, from its resemblance to the keel or prow of a boat, and which usually encloses the stamens and pistil. Stamens ten, rarely five, inserted with the corolla, monadelphous, diadelphous, (mostly with stamen united in one set in a tube, which is cleft on the upper side, that is next the standard, and the tenth or upper one separate), or occasionally distinct. Ovary, one-celled, sometimes two-celled by an intrusion of one of the sutures, or transversely two many celled by cross division into joints; style simple, ovules amphitropous, rarely anatropous. Cotyledons large, thick or thickish; radicle incurved. Leaves simple or simply compound, the earliest ones inmination usually opposite, the rest alternate. Leaflets always quite entire. Flowers perfect, solitary or axillary, in spikes, racemes, or panicles.

LUPINUS PERENNIS, L—(*Common wild Lupine.*)

A genus largely scattered over the West with over 50 species. Our species is blue flowered in a large receme with a palmately 5-15 leaved foliage. Not frequent. (Palmately means like the leaves of the buckeye). Eatable. Flowers April and May. Alleghany Mountains.

CROTALARIA SAGITTALIS, L. Rattlebox.

Flowers in racemes, commonly yellow, stem erect, branching. Leaves oblong laneolate, stipules united and decurrent on the stem, legumes much inflated. Plant hairy. Valuable, g owing abundantly in the State in sandy soil. June and September.—*Good.*

MELILOTUS ALBA, Lam.—(*White Melilote, not indigenous.*

Cultivated as forage.

TRIFOLIUM PRATENSE, L.—(*Red clover already described.*)

TRIFOLIUM ARVENSE, L—(*Rabbit foot clover.*)

Annual, silky, erect, heads cylindrical. No use.

TRIFOLIUM REFLEXUM, L—(*Buffalo clover.*)

Biennial; stems ascending, downy; leaflets obovate, oblong finely toothed. Stipules thin, ovate; pods 3-5, seeded. Valuable. Round Nashville.

TRIFOLIUM REPENS, L--(*White clover.*)

Universally known.

TRIFOLIUM CAROLINIANUM, Michx--(*Carolina clover.*

Small, procumbent, corolla purplish. Does not afford much forage.

MEDICAGO LUPULINA, L—(*Black Medick.*)

Stem procumbent. Heads of flowers roundish, ¼ inch diameter, pale yellow. Abundant in dry pastures. Sheep feed on it. It is introduced from Europe and an annual. May and August.

PSORALEA MELILOTOIDES, Michx--*Psoralea.*

Calyx 5, a cleft, persistent, the lower lobe longest. Pod strongly wrinkled; leaves pinnately 3-folialate stem erect, 2-3 feet high. Perennial. Very good for all stock. Common.

PSORALEA SUBACAULIS, Torr and Gray.

Nearly stemless; leaves palmate, 7-folialate. Root with a tuber. Flowers purple, in May. Cattle feed on it. Nashville, rare.

PETALOSTEMON FOLIOSUS, Gray.—(*Leafy Prairie Clover*).

Perennial. Flowers in a spike, rose-colored Stem erect, smooth;

leaves pinnate, with very numerous small leaflets; whole plant glandular dotted. Cedar barrens. June—August. Very valuable plant.

PETALOSTEMON DECUMBENS, Gray.

Perennial. Decumbent. Leaflets very thin, narrowly linear, corolla rose-purple, with the former.

PETALOSTEMON CANDIDUS, Michx.

Leaflets 7-9, lanceolate or linear-oblong; corolla white Cumberland Mountains. July—August

PETALOSTEMON CORYMBOSUS, Michx.

Stems clustered, erect, very leafy. Leaflets 3-7 filiform; teeth of the calyx setaceous, plumose; vexillum oblong. June—August. Dry cedar barrens. All Petalostemons are excellent herbage.

AMORPHA FRUTICOSA, L.--(*Lead Plant, or False Indigo*).

Shrubs with odd pinnate leaves; flowers purple. A tall-growing shrub. Confined to creek and river banks.

ROBINIA PSEUDO-ACACIA, L.--(*Common Locust*),
ROBINIA VISCOSA, Vent--(*Clammy Locust*),
ROBINIA HISPIDIA, L.--(*Rose Acacia*),

Are generally known. Planted in avenues—the two latter in gardens for their gorgeous blossoms.

WISTARIA FRUTESCENS, D. C.

Woody twiner, climbing high, with minute stipules, and dense recemes of large and showy lilac-purple flowers. Often cultivated for ornament.

TEPHROSIA VIRGINIANA, Pers.--(*Goats Rue*).

Calyx about equally 5-cleft. Standard roundish usually silky outside turned back, scarcely longer than the coherent wings and keel. Silky, villous. Leaflets 7-29 linear, oblong. Flowers showy. Roots long, slender and very tough. Perennial. Worthless.

TEPHROSIA SPICATA, Torr & Gray.

Similar to the foregoing, but the spikes loose, long, peduncled and few flowered Perennial. Not worth much.

ASTRAGALUS TENNESSIENSIS, Gray.----(*Tennessee Milk Vetch*).

Calyx 5-toothed, corolla long and narrow; standard narrow, equaling or exceeding the wings and blunt keel; its sides reflexed or spreading. Pale yellow. Pod short and very thick appressed to the rocky soil in which it grows. May. Cedar barrens. Very valuable.

ASTRAGALUS CANADENSIS, L.---(*Canada Milk Vetch*).

Tall, pubescent; leaflets 21-31. oblong obtuse, stipules ovate, clasping; peduncles as long as the leaves, closely many-flowered. Flowers ¾ inch long, pale yellow. Nashville. Rocks and cliffs of Cumberland river. Good forage plant

VICIA MICRANTHA, Nutt.--(*Small Flowered Vetch*).

Calyx tubular. 5-cleft, style filiform, hairy at the apex. Smooth, leaflets 4-6 linear. obtuse; peduncles 1 2 flowered. Flowers minute, pale blue; legume sabre shaped, 4-10 seeded. Thickets Common. April. Good.

VICIA CAROLINIANA, Walt.--(*Carolina Vetch*).

Leaflets 8-24 oblong, obtuse, scarcely mucronate peduncles loosely flowered: calyx teeth very short. With the preceding. May. Very good.

VICIA AMERICANA, Muhl.

Leaflets 10-14 elliptical or ovate oblong very obtuse many veined: peduncles 4–8-flowered. Flowers purplish, 8 lines long showy. The Vicias are climbing, tendril bearing, and all equally valuable. The last deserves to be cultivated.

STYLOSANTHES ELATIOR, Swartz.--(*Pencil Flower*).

Yellow flowering, low; perennial; branched from the base with wiry stems, pinnately 3-foliolate leaves, the small orange yellow flowers in few flowered clusters. June—October. Cattle feed upon it.

LESPEDEZA REPENS, Torr & Gray.--(*Creeping Bush Clover*).

Calyx 5-cleft; the lobes nearly equal, slender, stamens diadelphous. Pods of a single, one-seeded joint, oval or roundish, flat, reticulated;

leaves pinnately 3 foliolate, smooth, prostrate, spreading, very slender. Dry, gravely localities. June—September.

LESPEDEZA VIOLACEA, Pers.—(*Purple Bush Clover*).

Stems upright or spreading, branched; leaflets varying from oval oblong to linear, whitish, downy beneath with close-pressed pubescence; peduncles or clusters few flowered; pods ovate July—September. Copses. Common.

LESPEDEZA STUVEI, Nutt.—(*Downy Bush Clover*).

Stems upright, spreading, bushy, downy; leaflets oval or roundish, longer than the petiole, silky or white wooly beneath, clusters many flowered. With the foregoing. July—August.

LESPEDEZA HIRTA, Ell.—(*Hairy Bush Clover.*)

Flowers in a cylindrical rather loose spike; corolla whitish with a purple spot on the standard; leaflets roundish or oval, hairy. Plant upright, wand-like, 2-4 feet high. Dry hills and barrens. July.

LESPEDEZA CAPITATA, Michx.—(*Round-headed Bush Clover*).

Similar to the foregoing, but the leaflets elliptical or oblong, thickish, reticulated and mostly smooth above, silky beneath, spikes or heads dense, nearly globular. With the former July—August.

The four last described Lespedeazs are exceedingly valuable pasture plants. Lespedeza striata, the Japan clover, already described, is now quite common in many countries, but the American indigenous species would prove equally as valuable.

DESMODIUM, D. C.—(*Tick Foil*).

Calyx more or less 2-lipped. Standard obovate; wings adherent to the straight and usually truncate keel, by means of a little transverse appendage on each side of the latter. Stamens diadelphous 9 and 1, or monadelphous. Pod flat, deeply lobed on the lower margin, separating into few or many flat reticulated joints, (mostly roughened with minute hooked hairs, by which they adhere to the fleece of animals or to the clothing). Perennial herbs with pinnately 3-foliolate (rarely 1-folioate) leaves, stipellate.

This is a large genus with 28 species in the Atlantic part of the Western States, and most species are very common and abundant.

DESMODIUM PAUCIFLORUM, D. C.--(*Sparsely-flowered Tick-Trefoil*).

Leaflets rhombic-ovate, bluntish, pale beneath ; raceme few flowered, terminal. Woods common. June--September.

DESMODIUM ACUMINATUM, D. C.--(*Sharp pointed Tick-Trefoil.*)

Leaves all crowded at the summit of the stem, from which arises the elongated naked raceme or panicle; leaflets round ovate, taper-pointed, green both sides. Woods, common.

DESMODIUM NUDIFLORUM, D. C.--(*White-flowered Tick-Trefoil*).

Leaves all crowded at the summit of sterile stems; leaflets broadly ovate, bluntish, whitish beneath; raceme elongated on an ascending mostly leafless stalk or scape from the root, 2 feet long, Woods, common. August—September.

DESMODIUM CUSPIDATUM, Torr & Gray.--(*Cuspidate Tick-Trefoil*).

Very smooth except the panicle; stem straight; leaflets lanceolate, ovate and taper-pointed, green both sides; longer than the petiole 3-5 inches long, joints of the pod rhomboid, oblong, smoothish. Common. June—September

DESMODIUM ROTUNDIFOLIUM, D. C.-(*Round Leafed Tick-Trefoil.*)

Soft, hairy all over, truly prostrate; leaflets orbicular, or the odd one slightly rhomboid; pods almost equally sinuate on both edges, 3-5 jointed ; the joints rhomboid-oval. Common. June--September.

DESMODIUM CANADENSE, D. C. (*Canadian Tick Trefoil*).

Stem hairy; (3-6 feet high). Leaflets oblong, lanceolate or ovate, lanceolate, obtuse, with numerous straight veins, much longer than the petiole, (1½-3 inches long); flowers showy, larger than in any other species, 1-3 to 1-2 inch long. East Tennesseee August, September.

DESMODIUM DILLENII, Darl--(*Dillens Tick Trefoil*).

Stem pubescent; leaflets oblong. or oblong-ovate, commonly bluntish, pale beneath softly and finely pubescent. Open woodlands; common. July, September.

DESMODIUM PANICULATUM, D. C.--(*Smooth Tick Trefoil.*)

Nearly smooth throughout; stem slender, tall; leaflets oblong-lanceo-

late, or narrowly lanceolate, tapering to a blunt point, thin, 3-5 inches long; racemes much panicled; June, September; common.

DESMODIUM STRICTUM, D. C.--(*Stiff Tick Trefoil*).

Stem very straight and slender, simple, 2-3 feet high, the upper part and narrow panicle rough, glandular; leaflets linear, blunt, strongly reticulated thickish, very smooth, 1-2 inches long, ¼ inch wide; joints of the pod 1-3 semi-obovate or very gibbous, only two lines long. Cedar barrens.

The main bulk of the pea-vine food found in the forest and uncultivated regions, consists of the various species of this genus, several of which would certainly do well in cultivation. Amongst those, D. pauciflorum, and D. nudiflorum, cuspidatum and Canadense are best.

APIOS TUBEROSA, Mœnch--(*Ground nut.*)

A twining and climbing vine; flowers in crowded oval racemes, fragrant, of a dull purple, mixed with green; legume 3-5 inches long, 8-10 seeded; plant with some milky juice. August, September. The root bears tubers which are farinaceous and eatable. Hogs know how to find them. The plant ought to be tried under cultivation, as the size and quality of the tuber would perhaps become gradually improved.

PHASEOLUS PERENNIS, Walt---(*Wild Kidney Bean*).

Calyx 5-toothed, or 5-cleft, the two upper teeth higher united; keel of the corolla with the included stamens and style spirally coiled or curved into a ring; stamens diadelphous; climbing higher from a perennial root; leaflets roundish, ovate, short panicled; pods drooping, strongly cured, 4-5 seeded; flowers purple, handsome. Copses, common; valuable. July, September.

PHASEOLUS DIVERSIFOLIUS, Pers--(*Creeping Kidney Bean*).

Annual; stem prostrate, spreading, rough, hairy; leaflets ovate; 3-lobed, or angled towards the base, or some of them oblong, ovate and entire; peduncles at length, twice the length of the leaves. Corolla greenish white tinged with purple. Prairies and cedar glades; summer. Good.

PHASEOLUS HELVOLUS, L.---(*Long Stalked Kidney Bean*).

Perennial, hairy; stem diffuse, slender; leaflets ovate or oblong, entire or obscurely angled. Peduncles 3-6 times the length of the leaves Flowers as large as in the former, and similar. One single plant makes a great quantity of herbage. It could perhaps be gathered with some profit and used from the native state. Good for all stock.

CLITORIA MARIANA, L--(*Butterfly pea*).

A low, ascending or twining plant, with pinnately, 3 folialate leaves, and very large, pale blue flowers, July. Eatable, but too scattering.

CENTROSEMA VIRGINIANUM, Benth--(*Spurred Butterfly Pea*).

Corolla much like in the foregoing, but the spreading standard with a spur shaped projection on the back near the base; pod long and linear, many seeded, thickened at the edges A twining perennial. with 3 foliolate stipulate leaves. and large, showy flowers. Corolla 7 inches long, violet. Common. Forage plant. Flowers all summer.

AMPHICARPÆA MONOICA, Ell--(*Hog pea nut*).

Flowers of two kinds; those of the racemes from the upper branches perfect, but seldom ripening fruit; those near the base and on creeping branches with the corolla none or rudimentary, and few free stamens, but fruitful, calyx about equally 4 (rarely 5) toothed; bractlets none, or minute; keel and wing petals similar, almost straight, the standard partly folded round them. Stamens diadelphous; style beardless; pods of the upper flowers when formed somewhat scymetar-shaped, 3-4 seeded; of the lower ones commonly subterranean, obovate or pear shaped, fleshy; ripening usually but one large seed. A low and slender perennial, the twining stems clothed with brownish hairs; leaves pinnately 3-foliolate; leaflets rhombic, ovate, stipulate. Flowers small, in clusters, or compound racemes, purplish. The subterranean pods are hairy and greedily eaten by hogs. The herbage makes very good food. The fruit burrowing habit of this species is very similar to that of the African pea nut. It abounds round Nashville, and requires rich soil in the woods. Flowers all summer.

GALACTIA MOLLIS, R. Brown--(*Milk Pea*).

Low, prostrate and twining perennial; leaflet 3 stipulate, oval, soft, downy and hairy beneath; flowers in interrupted or somewhat knotty racemes, purplish, pods very downy; flowers in summer.

GALACTIA GLABELLA, Michx.--(*Smooth Milk Pea*).

Stems nearly smooth, prostrate; leaflets elliptical or ovate, oblong, sometimes slightly hairy beneath; racemes short, 4-8 flowered; pods somewhat hairy; flowers large, rose-purple. They are what their name indicates, excellent food for milk cows. Abundant in the State.

BAPTISIA TINCTORIA, R. Brown--(*Wild Indigo*).

Calyx 4-5 toothed. Standard not longer than the wings, its sides re-

flexed: keel petals nearly separate, and, like the wings, straight, stamens 10, distinct, pod stalked in the persistent calyx, roundish or oblong, inflated, pointed, many seeded, smooth, 2-3 feet high, rather glaucous: corolla yellow, ½ inch long. Flowers in July and August.

BAPTISIA LEUCANTHA, Torr & Gray—

Smooth; 1-3 feet high slender and the branches wide spreading; very similar to the foregoing, but pod long-stalked, and standard of the corolla very short. Flowers white.

BAPTISIA ALBA, R. Brown—(*White Baptisia*).

Similar to the former; flowers white, pods linear, oblong, short stalked. The branches of the pyramidal growing plant slender and widely spreading. May.

BAPTISIA AUSTRALIS, R. Brown--(*Blue, False Indigo*).

Is of similar habit, but taller and stouter; 4-5 feet high; raceme elongated, 1-2 feet long; flowers one inch long. indigo blue; often cultivated in gardens. (Bridgeport). Flowers in summer. The Baptisias are generally not touched by any stock. In drying they turn black.

THERMOPSIS MOLLIS, Curtes--(*Downy Leafed Thermopsis*).

Genus like Baptisia, but with a long, narrow flat pod; plant 1-2 feet high; minutely soft, downy; leaflets wedge obovate, varying to oblong; raceme reclining flowers golden yellow, pod long and linear. This is a rare plant in this State, and found yet but in one locality, on Judge Lee's place, top of Harpeth ridge. For several years in succession the cattle had eaten it down in a measure that I could obtain but two good specimens It flowers in June.

CLADRASTIS TINCTORIA, Raf--(*Yellow wood*).

Attains considerable size in the Harpeth hills by Nashville. One tree measured 10 feet round about 4 feet above the ground. Its hight, however, was only about thirty feet. Other specimens attain more hight by less thickness. Flowers similar to the locust. Well enough known in this region.

CERCIS CANDENSIS, L--

The red bud needs no description. It ought to be used as an ornamental tree.

GLEDITSCHIA TRIACANTHOS, L--(*Honey Locust*).

Its pods are eaten by stock, and young trees are frequently kept down in a stunted condition from the biting and browsing of stock.

GLEDITSCHIA MONOSPERMA, Walt-- (*Swamp Locust*).

With less and simple thorns, and small, oval, one seeded, and pulpless pods, is a small tree, growing in the Mississippi bottoms, never seen by me in the Middle and Eastern parts of the State.

GYMNOCLADUS CANADENSIS, Lam --(*Coffee Tree.*)

Leaves 3 feet long, with several large, partial leafstalks, bearing 7-13 ovate, stalked leaflets, pod 6-10 inches long, 2 inches broad, the seed over ½ inch across. This is one of the noblest forest trees, timber valuable. It ought to be planted in parks and at road sides.

CASSIA MARILANDICA, L--(*American Senna.*)

Perennial herb with simple pinnate leaves, showy; yellow flowers in axillary raceme, the upper ones panicled. Leaflets 6-9 pairs, lanceolate oblong obtuse; petiole with a globe-shaped gland near the base; pods linear, slightly curved. Leaves used as a substitute for the officinal senna.

CASSIA OBTUSIFOLIA, L--(*Wild Senna*).

Annual; leaflets 3 or rarely 2 pairs, obovate, obtuse, with an elongated gland between those of the lower pairs or lowest pair, pods slender, 6 inches long, curved. Common on river banks and in waste places. No use. Not touched by stock.

CASSIA CHAMÆCRISTA, L--*Partridge Pea*

Leaflets small, 10-15 pairs, linear, oblong, oblique at the base, flowers large, on slender petioles, anthers 10, elongated, unequal; 4 of them yellow, the others purple, style slender. Sandy fields, common. Sometimes eaten by cattle.

CASSIA NICTITANS, L--(*Wild Sensitive Plant*).

Like the former sensitive to the touch, especially so in hot weather. Leaflets 10-20 pairs oblong, linear, flowers small, on very short pedicels, anthers 5, nearly equal with the former. Of no utility.

ACACIA JULIBRISSIM, L—

Is a fine ornamental tree of the Mimosa family, the third Suborder of the Leguminosæ, (Cercis, Cassia, Gymnocladus, Gleditschia, belong to the second suborder, or Cæsalpsineæ). The Mimosæ have regular flowers, corolla valvate in æstivation, stamens often very numerous. Leaves twice pinnate. A large tree of this kind of about 30 feet high and nearly 1 foot in diameter, demonstrating sufficiently its adapta-

bility to the climate, did exist formerly corner Vauxhall and Broad streets, Nashville, and has recently very injudiciously been cut down. Native of Palestine. It makes a very ornamental tree.

DESMANTHUS BRACHYLOBUS, Willd--(*Desmanthus.*)

This and the next two belong to the Mimosas or sensitive plants. It is also sensitive to the touch; soon folding its 2-pinnate foliage; nearly glabrous, erect, 1-4 feet high, light green; partial petioles 6-15 pairs, leaflets 20-30 pairs; stamens 5. Pods oblong, sickel-shaped, about one inch long, forming a globular cluster. Frequently met with in dry cedar barrens. They are much liked by horses and other stock. In cultivation, with a proper management of planting and working, it would produce an immense quantity of food.

SCHRANKIA UNCINATA, Willd--*and*

SCHRANKIA ANGUSTATA, Torr & Gray--(*Sensitive Briar.*)

Are two small creeping briars, very sensitive, with small gloubular heads of rose colored delicate flowers. Both occur on siliceous soil and are visited by sheep and cattle, notwithstandtng their prickly stems and peticles. Growing all summer.

CHAPTER XXVI.

PEANUT, GOOBER PEA, GROUND PEA.—*Arachis hypogæa*.

The principal characters of the genus are the immensely long tube of the calyx, whose limb is two-lipped; the corolla papilionaceous and yellow, and eight stamens united in one parcel. The ovary is very small, and is placed at the bottom of the very long calyx tube; it contains two ovules, and is terminated by a very long style, thickened at its extremity, and covered with hairs at the place where it comes in contact with the stamens. After the fall of the flower, the ovary, which is very small, is gradually raised upon a stalk which, in time, attains at length two to three inches, and in its growth curves downwards, so that a length of the small ovary at its extremity is thrust into the ground. When this happens, the ovary begins to enlarge and ripens into a pale yellowish, wrinkled, slightly curved pod, often contracted in the middle and containing two seeds. Should the ovary, by some accident, not be enabled to thrust its pods into the ground, it withers and does not attain perfection.

The Peanut is supposed to be indigenous to Africa, and within the last few years has become of great commercial importance. Large quantities are grown on the western coast of Africa and in South America. It is also cultivated

in Virginia, North Carolina, Georgia, Alabama and Tennessee, Virginia taking the lead in its production.

The principal peanut growing counties in Tennessee are Perry, Hickman, Humphreys, Dickson and Lewis. Two varieties are known in Tennessee, the red and the white. The red grows with an erect stem and is more easily cultivated, the largest portion of the work being done with the plow. The white peanut grows flat on the ground, spreading out and forming the rigid, deflexed stalk to which the forming pod is attached in the ground. The white is the most prolific, is later in coming to maturity than the red, but brings usually a better price in market. The red matures better because earlier, and yields fewer imperfect ones called " puffs " or "pops."

An argillaceous soil, filled with light pebbles, so as to make it loose and prevent baking, is the best for peanuts. The brighter the pebbles and clay the better the peanuts, the color of the soil affecting the color of the peanut and their markst value. Uplands, with an original growth of hickory and white oak, with a light clay, are greatly preferred for this reason to the black soils of the bottoms. While the latter may yield a greater quantity of nuts per acre, they are not so marketable, and are classed among the lower grades.

The land is usually preparred in April, after the danger of frost is past. It is seldom subsoiled, but well harrowed, so as to pulverize it thoroughly. For white peanuts it is then checked off in rows two and a half or three feet apart, and two kernels, after being carefully hulled by hand, are dropped, like corn, at the intersection of the furrows, and covered with a hoe an inch and a half or two inches deep. It is often difficult to obtain a good stand. Should the land become compacted, after planting, by a hard rain, a harrow should be run over it, when sufficiently dry, to break the obstructing crust so that the plumule, which is very delicate and tender, can push its way to the surface. The brown

millipede, cut-worms and moles are all great enemies to the peanut when first planted. Should the plumule fail to make its appearance after ten days of favorable weather, re-planting should begin.

Red peanuts are usually planted in ridges like cotton. The seeds are dropped along in the furrow which is opened on top the ridge, from eight to twelve inches apart, and covered by a board, like cotton seed, some two inches deep. About two and a half bushels in the hull are required to plant an acre. Very fertile lands are not suited to this crop, for the reason that too much vine is objectionable, as the peanuts continue to form without maturing. For this reason very few fertilizers are used in making the crop.

The after culture of the peannt is very simple. Keep down the weeds and stir the ground often with a harrow, and finally with double shovels, so as to leave a loose surface. The soil is usually thrown up to the red peanuts, but level culture is demanded for the white. The crop is usually "laid by" about the first of August, the bunches of grass escaping the plow being carefully cut out and the the ground left light and loose. A dry spring is very much to be desired in the cultivation of this crop. After the spikelets begin to push down into the soil, frequent showers are indispensable to a large yield.

The crop of white peanuts is harvested by running a furrow on each side of the row with a bull-tongue plow or a pea-digger, so as to dislocate the roots. Care must be taken not to detach the nuts from the vine in running the side furrow. After the plow has been run on eaeh side of the row, (and it is sometimes necessary to run twice on a side), then lift the vines gently with the hand, carefully shaking the dirt off, and lay them on the ground. Let them remain in this way, if the sun is shining, from six to eight hours. The vines will wilt like clover, when they may be brought together and stacked.

The stacks are made around a pole planted in the ground and rising some eight feet above the surface. A platform made of old rails is laid down upon logs around the pole, so as to protect the nuts and vines from the mould and dampness of the ground. In stacking. the nuts should be put on the inside next to the stack-pole, but not so close but that air can circulate freely from the bottom to the top of the stack. To make the stack entirely secure, it should have a capping of hay or corn fodder. Put up in this manner the nuts will keep securely all the winter should it be desired.

The red nuts are more easily harvested than the white, as they have but few root and the nuts adhere closely about the stem. In loose land they may be pulled up without running a furrow on each side of the row, though to do this will make the work much easier.

Usually the nuts are allowed to stand in the stacks about four weeks, and are then picked off by hand, the white always, the red sometimes being threshed off by taking up bundles and beating against a rail or the side of a box. This latter plan greatly injures the peanuts. Five to six bushels of red peanuts can be picked off the vines in a day by a nimble fingered hand, but the picking of three to four bushels of the white is considered a good days work. Women and children are said to be much more expert in picking off the peanuts than men. The price paid for picking is about ten cents per bushel. After this they ought to be screened in a cylinder so as to separate them from the dust and leaves, and also for the purpose of brightening the hulls by abrasion against one other. After sunning they are put in sacks containing four to five bushels.

The weight of a bushel of peanuts in Tennessee, is 23 pounds; in Georgia 28; in North Carolina and Virginia 22 pounds. The Tennessee peanuts are larger than those of Georgia, and smaller than those of North Carolina and Virginia. Of those raised in Tennessee fully three-fourths

are of the red variety. The usual yield per acre is from thirty to fifty bushels, though as high as 100 bushels are sometimes made. The white peanuts will make from ten to twenty bushels per acre more than the red, but not being so easily cultivated or gathered, they are considered less valuable.

The analysis of the peanut, according to Antisell, husk and nut, shows it to contain in 100 parts:

Water,	2.60
Albuminoids, fibre and starch,	79.26
Oil,	16.00
Ash,	2.00
Loss,	.14

The seed alone contains in 100 parts:

Moisture,	2.51
Albuminoids and farina,	79.71
Ash,	1.77
Oil,	16.00

The husk contains about one-sixteenth of the whole weight of the peanut. The ash consists of soluble phosphates of soda and ammonia with a small amount of common salt. Super-phosphate of lime ought to be a good manure for them.

The seeds of some varieties are said to contain from 40 to 50 per cent of oil resembling olive oil and used for similar purposes. A large amount of the oil is used in the manufacture of soap. Peanuts are also used in making confectioneries, and are eaten like almonds and other nuts. The haulm or vine, when carefully harvested before it has been injured by frost, is considered an excellent food for cattle and sheep. Horses are also exceedingly fond of it, but the large amount of dirt which necessarily adheres to it is apt to produce a disagreeable cough in horses. The red peanut makes better hay because it grows erect, and is

therefore freer from dirt. About one ton is usually saved per acre, though upon strong land, where the vines grow very luxuriantly, two tons or more have been saved from a single acre. Many practical farmers prefer it to clover hay. Like clover hay it must be handled carefully, or the leaves fall off, leaving nothing but the stems, which are nearly worthless. When fed to milch cows it is said to produce a copious flow of rich, creamy milk. Ewes in lambing time can have no better feed given them than well cured peanut vines. Their flow of milk is increased and its quality enriched.

The best of farmers, however, scatter the hay over the land intended to be planted in peanuts, and it proves to be an excellent fertilizer. The peanut, like all oily products of the soil, is a very exhaustive crop, and if the hay is not returned to the soil the land will not yield more than two good crops in succession. The best plan is to rotate the peanut crop with the wheat crop, and use some of the superphosphates. They are good fertilizers for both crops.

The estimated production of this crop in Tennessee, as made by Gennett & Co., the largest dealers in the State, for the five years ending 1877, is as follows:

1873,..	600,000	bushels
1874,..	150.000	"
1875,..	200,000	"
1876,..	450,000	"
1877,..	200,000	"

It is a singular fact that, notwithstanding the importance and value of this crop, no report of it has ever been made in the United States census.

The best markets are Nashville, Cincinnati, Pittsburgh and New Orleans, which usually take the whole Tennessee crop. About 105,000 bushels were handled in Nashville in 1877. The quality of the Tennessee peanuts is considered not equal to those of Virginia, but better than those of

Georgia and other States. Carelessness in handling only makes them inferior to the Virginia crop.

Marketable peanuts are free from puffs, dirt and trash, and have a bright hull, and should be put in four bushel burlaps, well filled, but without crushing the hulls.

I am indebted mainly to W. O. Britt, Britt's Landing, and to W. K. Jackson, Box Station, for the facts embraced in this paper on peanuts. Both gentlemen have had extensive experience in their growth and sale.

CHAPTER XXVII.

PEA--(*Pisum Sativum*).

Smooth and glancous, with large leafy stipules, commonly two pairs of leaflets, branching tendrils, and peduncles bearing two or more large flowers; corolla white, bluish, purple or partly-colored; pods rather fleshy.—*Gray.*

The pea is a native of southern Europe, and its cultivation extends into every State. The varieties are very great, and while some are cultivated extensively for table use other kinds are raised for stock and for manurial purposes. Our garden pea was cultivated by the Greeks and Romans. Peas were found in the ancient Swiss lake dwelling. They were introduced into England in the time of Henry VIII, and is there still a standard crop. They are sown or drilled in and are sometimes even sown with oats, the two being harvested and fed together. Sheep and hogs are very fond of them, and especially are the vines prized as a sheep fodder. Analysis shows that peas contain: Ash, 2.5; albuminoids or flesh formers, 22.4; carbo-hydrates or heaters, 52.3, crude fibre, 9.2; fat, 2.5; water, 14.3. The composition shows them to be very nutritious, and animals fatten rapidly when fed with them liberally. The pea haulm when dry gives by analysis: Water, 14.3; ash, 4.; albuminoids, 6.5; carbohydrates, 35.2; crude fibre, 40; fat, 2. This shows the haulm to be three times as valuable for feeding purposes as wheat straw, and a little more valuable as a feed than barley straw mixed with clover, and one third better than common fodder.

The cow or field pea of the Southern States is more like

a bean than a pea, and is supposed to be a species of *dolichos* belonging to the pulse family whose species is undetermined. Be this as it may, its value as a farm crop has long been known. The ease with which it is cultivated and its great value as a forage plant and as a fertilizer have given it a prominent place in southern agriculture. It belongs to the leguminous or pulse family, and is known as a pea, and for that reason it will be treated of under that head.

The letter below, from the Hon. H. M. Polk, of Hardeman county, is so thorough and exhaustive that nothing more need be said on the subject, only remarking that no soil in this State is so poor that it will not grow peas.

BOLIVAR, HARDEMAN COUNTY, TENN., July 2, 1878.

Commissioner J. B. Killebrew:

I will not stop to demonstate what is manifest to all that the South, from her sparse population, her wide-spread plantations, her adaptation to, and her predilection for the cultivation of certain of our great Southern staples, is not at this time and may never be in a condition to keep up her arable lands by animal manures alone, and that her only alternative is in green crops turned under for renovating and increasing the productive capacity of her soil.

In estimating the relative manurial values of green crops to bring up the productive capacity of our soils, we measure by the amount of crop produced in the shortest time, the elements upon which these crops feed, their capacity for returning plant food to the earth, and especially by their leaving more or less of those elements in the soil which are necessary to the production of the succeeding crop Nor do we omit to estimate their several capacities for sending their roots deeply into the soil, thereby bringing up and depositing near the surface the aliment for plants which would otherwise remain below the reach of the roots of many of our most valuable cereals. For the accomplishment of these purposes no vegetable equals the southern field pea and red clover. In them we find the answer to that momentous question, how, and through what means can we, in the shortest space of time, bring our lands up to their highest productive capacities to meet our own and the varied wants of society. When we reflect that all progress, civilization, refinement, culture, prosperity and happiness of society hang suspended upon the scale which measures out the feeding capacity of the earth, we begin to appreciate those vegetable productions promotive of this desired end. The trefoils and legumes then begin to loom up in their grand possibilities; and the clover and the field pea assume an importance not dream-

ed of before. Without them, on the one hand we must descend to meager harvests, perishing stock, fast approaching sterility, hard times and general discontent. On the other, by their powerful aid we ascend up to plentiful harvests, fat stock with the multiplied advantages resulting therefrom good living, money in the purse, prosperity and contentment. Can the pea and clover accomplish all this? Worked in proper rotation with other crops they most assuredly can. In the heathen, but appreciative past, when gratitude was manifested by the erection of temples, and by solemn worship to those deities from whom temporal blessings were thought to flow, the pea and clover of the present day have been entwined with the wheat and fruit—crowning the brow of beneficent Ceres. Now, these mainsprings of successful agriculture in our favored land are but half appreciated, and are thrust aside by the impatient tiller of the soil for some other crop supposed to bring in more immediate money profits; but which in its continued drafts upon the fertility of the soil, must end in the bankruptcy, as well as the ruin of its possessor.

In a previous letter to you I stated some of the advantages which the field pea possessed even over its great fellow laborer, red clover, as a fertilizer.

1st. The pea will thrive upon land too poor to grow clover.

2d. That it will produce a heavy and rich crop to be returned to the soil in a shorter period than any vegetable fertilizer known.

3d. That two crops can be produced on the same ground in one year; whereas it requires two years for clover to give a hay crop, and good aftermath for turning under. In this time four crops of peas can be made.

4th. That the pea feeds but lightly upon, and hence leaves largely in the soil, those particular elements necessary to a succeeding grain crop, and the pea lay, in its decay, puts back largely into the soil those very elements required for a vigorous growth of the cereals.

5th. There is no crop which is its equal for leaving the soil in the very best condition for a succeeding wheat crop

6th. It is the only crop raised in the South so rapid in its growth and perfection as to be made an intervening manurial crop between grain cut in the spring, and grain sowed in the fall, upon the same ground. And this alone makes the pea invaluable to Southern agriculture.

7th. In our particular latitude it flourishes equally with clover: and with two such renovators of the soil (aside from their value as food crops), no portion of the earth is equally blessed. North of us the pea does not succeed; south, the clover fails.

8th. Its adaptability to other crops, producing in the space between

our corn rows both a provision and a fertilizing crop, with positive benefit to the growing corn.

9th. The aid it gives in producing cheap beef, pork, milk and butter. Without the pea pork could not be produced cheaply, where it costs so much to make corn.

10th. A doubled capacity for wintering stock, and with this, a doubly enlarged manure heap.

11th. The large plantations of the South can only be restored by green crops turned under, united to a judicious system of rotation looking to feeding the soil. This must be aided by all the manure manufactured on the plantation.

12th. The large addition made to humus, upon which the tilth, as well as capacity of the soil for retaining moisture so greatly depends.

As for the cultivation of the pea, one can scarcely go amiss. When two crops are intended for renovating, break the land, sow broadcast and harrow in. Or drill in rows three feet apart, and plow out when a few inches high. When pods begin to ripen, if the crop is intended for manurial purposes, plow under with large two horse plow, with a well sharpened rolling coulter attached, or with chain passing from double tree to beam of the plow to hold the vines down for facilitating covering. A roller passed over the vines before plowing under will assist the operation. Caustic lime should be sown upon the vines before plowing under to promote decay, and neutralize the large amount of vegetable acid covered into the soil. Select the pea which runs least. The vines are easiest covered into the soil. They are the black bunch pea, and the speckle or whippoorwill pea.

When planted in corn as a food crop, the bunch pea ripens soonest; but the Carolina cow pea, the clay pea, or the black stock pea are preferable as they do not readily rot from wet weather, and will remain sound most of the winter. For early feeding of stock, plant whipporwill pea by itself in separate enclosure from corn, where stock can be turned upon whenever desired.

Peas are often sowed upon the stuble after small grain is harvested. Flush up the ground, and sow either broadcast, or drill in furrow opened with shovel plow, covering with scooter furrow on each side. Block off or run over lightly with harrow and board attached. Again they are drilled in every fourth furrow, when turning over the stubble, the succeeding furrow covering the peas. When either of these last modes of planting is adopted, the peas should receive one good plowing out when they are from four to six inches high.

When planted in corn (the corn should have been drilled in rows five feet apart), they should be stepdropped in a furrow equally distant from each corn row, and covered with scooter, with harrow or with block.

This should be last of May or in the first ten days of June. The only work they receive when planted in corn, is a shovel or sweep furrow run around them when the corn is being "laid by," unless there is much grass, when it becomes necessary to give them a light hoeing. The crop might be said to be made almost without work when planted with corn; in fact it is often so made by those planters who sow peas broadcast in their corn, and cover them with the last plowing given the corn

There is much diversity of opinion as to the proper treatment of the vines in curing them for winter hay. And as much has been written upon the subject, the writer feels some diffidence in giving his own views. Suffice it to say, the great end to be attained is to cure the vines to the extent only of getting rid of a part of the succulent moisture in the vine, without burning up the leaves. When exposed to too much heat, the leaves fall very readily from the stems, and are lost.

When put up too green and too compactly, they heat, and when fermentation of the juices in the vine and unripe pods occurs, the hay is seriously damaged, if not completely spoiled. Mildewed hay of any kind is but poor food for stock, and when eaten is only taken from necessity to ward off starvation. Some planters house their pea hay in open sheds, or loosely in barns, with rails so fixed as to prevent compacting. Others stack in the open air around poles, having limbs from two to four feet long, to keep the mass of vines open to the air, and cover the top with grass.

There is diversity of opinion as to the proper manner of curing and preserving this hay, but there is none as to the value of this rich food for all stock, and especially for the milch cow in increasing the quantity and quality of her milk.

In attempting to renovate our soils by the aid of vegetable fertilizers, we should not confine ourselves to one, but should utilize all which are suitable to our soil and climate. The writer has some sixty or seventy acres in clover, and in much of this grasses are sown. Orchard grass and herds grass thrive well with us, whilst blue grass and timothy finds a congenial home in the lime lands of Middle Tennessee. In no part of the State does clover grow better, if so well as in West Tennessee.

In considering the great advantages of the field pea to the agricultural interests of our people, I do not wish to be understood as disparaging other vegetable renovators of the soil. The field pea certainly possesses many advantages, such as its adaptability to almost any soil, and to many crops grown with it at the same time, and with positive benefit to the crop grown with it on the same ground. Each row of corn should be flanked by a row of peas. Every spot of ground in the field too poor for corn can and will produce peas. There is nothing

better to be sowed in old plowed up broomsedge fields, and there, whilst the land is being fertilized, one of the best provision crops for stock, and the best of hay for milk cows in winter, is produced. And a still further advantage possessed by this valuable legume is its unequaled capacity for, and its unapproachable merit as an intervening crop, (being both a renovating and a food crop), between small grain or root crop in the spring and a grain crop in the fall. Do you ask more of any vegetable renovator? It is more valuable than the English turnip crop, and this crop, by those enlightened and eminently practical farmers, is estimated annually at millions of pounds sterling. It is doubtful if England could tide it over the next two years if deprived of her turnip crop. It is the foundation of her stock and manure production. In contrasting the Southern field pea with the English turuip crop we begin to preceive its immense value to southern agriculture, and realize that too often, in reaching after the so-called money crops, we have neglected the best fertilizers, (as well as food crop), ever given to the agricultural world.

In considering the present impoverished condition of the lands of the South, we are forced to confess it is the work of tillage — of injudicious, ruinous tillage. Where husbandry predominates over tillage there is but little leaking out of the elements of fertility in a soil, and there is no estimating how long they will remain to supply the food necessary to vigorous plant growth. The grasses, including clover and peas, are the grand elements for preserving and augmenting these elements in the soil. Hence we see all countries where husbandry prevails grow rich in soil, particularly if the tilled portion of the land is under a judicious system of rotation. Now, tillage, or the simple cultivation of land, puts nothing of any value in it, but is, of itself, a necessary *evil*; evil because of exposing the soil to a scorching sun, often reducing it to a mass of lifeless clods, and exposing it to an exhausting leaching process, which takes out its very life blood. The *cleaner* and *longer continued* the culture, the more the injury to the land from the destruction of its humus, and from the greatest of all destructives, *leaching*. The injury is augmented as the land is rolling and broken. Hence cotton and tobacco (the first of which is not an exhauster of land, *per se*) have brought ruin to the best acres of the South, whilst small grain and the grasses have husbanded and increased the natural fertility of the lands of our Northern neighbors. Lands in which these two great staples are grown should be *level lands*, and in the case of tobacco should receive, (outside the aid of rotation), a generous manuring. But if I have given the true reason for the rapid decline of the productive capacity of the soil of the South as contrasted with that of the Northern States, let me take you one step further and show you that in the rich region of country lying northwest of the Ohio river, we find a very great difference in the material prosperity of the farmers there. A

portion of them are prosperous, whilst others are experiencing all the evils resulting from the comprehensive term *hard times*. It is not difficult to learn the cause. The grain maker, whose whole energies have been devoted to extracting the fertility of his soil for many consecutive years, in magnificent harvests, finds his crops growing less and less each year, while the stock-raiser is prosperous, having grown rich while making his land rich.

Time has here demonstrated a great truth which agriculturists should not ignore. Let our southern farmers profit by its inevitable teaching. Let us determine to improve our destructive farming; give our lands a chance to grow better instead of depreciating yearly; build up the waste places; infuse new life into our southern land, beautiful still in her decline, and endeared the more as we see her slowly sinking under the drain mercilessly kept open by her own children, in the veins through which her priceless life-blood flows.

Since writing the above, I have accidentally found an old document upon "Southern Agricultural Exhaustion, and its Remedy," from the able pen of the late Judge Ruffin, of Virginia. Although this article was not written specially upon the merits of the field pea as a renovator of worn lands, yet it shows its great value to the agriculture of the South so much more forcibly than anything I can say in advocating its claims that I take the liberty of quoting the following paragraphs entire, and with them will close my letter, already too long:

"At the risk of uttering what may be deemed trite or superfluous to many, I beg leave to state concisely the fundamental laws, as I conceive them to be, of supply and exhaustion of fertilizing matters to soils and aliment to plants.

All vegetable growth is supported, for a small part, by the alimentary principles in the soil, (or by what we understand as its fertility,) and partly, and for much the larger portion, by matters supplied, either directly or indirectly, from the atmosphere. More than nine-tenths, usually, of the substance of every plant is composed of the same four elements, three of which—oxygen, nitrogen and carbon—compose the whole atmosphere; the fourth—hydrogen—is one of the constituent parts of water; and, also, as a part of the dissolved water, hydrogen is always present in the atmosphere, and in a great quantity. Thus, all these principal elements of plants are superabundant, and always surrounding every growing plant; and from the atmosphere (or through the water in the soil) very much the larger portion of these joint supplies is furnished to plants; and so it is of each particular element, except nitrogen, much the smallest ingredient, and yet the richest and most important of all organic manuring substances, and of all plants. This, for the greater part, if not for all of its small share in plants, it seems, is not generally derived, even partially, from the air, though so abundant therein, but from the soil, or from organic manures given to the soil.

But, though bountiful nature has offered these chief alimentary principles and ingredients of vegetable growth in as inexhaustible profusion as the atmosphere itself which they compose, still, their availability and beneficial use for plants are limited in some measure to man's labors and care to secure their benefits. Thus, for illustration, suppose the natural supplies of food for plants furnished by the atmosphere to be three-fourths of all received, and that one-fourth only of the growth of any crop is derived from the soil and its fertility, still, a strict proportion between the amount of supplies from these two different sources does not the less exist. If the cultivator's land at one time, from its natural or acquired fertility, affords to the growing crop alimentary principles of value to be designated as five, there will be added thereto other alimentary parts, equal to fifteen in value, from the atmosphere. The crop will be made up of, and will contain, the whole twenty parts, of which five only were derived from and served to reduce by so much, the fertility of the soil. These proportions are stated merely for illustration, and, of course, are inaccurate; but the theory or principle is correct, and the law of fertilization and exhaustion thence deduced is as certainly sound. Then, upon these premises, there is taken from the land, for the support of the crop, but one-fourth of the aliment derived from all sources for that purpose. And, if no other causes of destruction of fertility were in operation, one green or manuring crop (wholly given to the land, and wholly used as manure) would supply to the field as much of alimentary or fertilizing matter as would be drawn thence by three other crops removed for consumption or sale. But in practice there *are* usually at work important agencies for destruction of fertility, besides the mere supply of aliment to growing crops. Such agencies are the washing off of soluble parts, and even the soil itself, by heavy rains; the hastening of the decomposition and waste of organic matter, by frequent tillage processes and changes of exposure; and ploughing or other working of land when too wet, either from rain or want of drainage. Also, a cover of weeds left to rot on the surface, or any crop ploughed under, green or dry, as manure, is subject to more or less waste of its alimentary principles in the course of the ensuing decomposition. Therefore, it is nearer the facts that two years' crops or culture, for market or removal, would require one year's growth of some manuring crop to replace, and to maintain undiminished or increasing the productive power of the field. The poorest, and also the cheapest, of such manuring crops will be the natural or "volunteer" growth of weeds on lands left cultivated, and not grazed; and the best of all will be furnished in the whole product of a broadcast sown and entire crop of your own most fertilizing and valuable field peas.

Thus, of each manuring crop, (as of all others,) or of the fertilizing matter thus given to the land, the cultivator has contributed but five parts from the land, or its previons manuring, and the atmosphere has supplied fifteen parts. If, then, the cultivator, by still more increasing his own

contributions, will give ten parts of alimentary matter to the land and crop, there will be added thereto from the atmosphere in the same three-fold proportion, or thirty parts, and the whole new productive power will be equal to forty. And if the soil is fitted by its natural constitution, or the artificial change, induced by calcareous or other applications, to fix and retain this double supply of organic matter, the land will not only be made, but will remain of as much increased fertility, under the subsequent like course of receiving one year's product for manure for every two other crops removed. But, on the other hand, if more exhausting culture had been allowed, instead of either increased or maintained production, or if the crops take away more organic matter than nature's three-fold contributions will replace, then a downward progress must begin, and will proceed, whether slowly or quickly, to extreme poverty of the land, its profitless cultivation, and final abandonment. In this, the more usual case, the cultivator's contributions of aliment (obtained from the soil) are reduced from the former value, designated as five, first to four, and next successively to three, two, and finally less than one; and nature keeps equal pace in reducing her proportional supplies from fifteen first to twelve, and so on to nine and six, and less than three parts. So the strongest inducement is offered to enrich, rather than exhaust the soil; for whatever amount of fertility the cultivator shall bestow, or whatever abstraction from a previous rate of supply he shall make, either the gain or the loss will be tripled in the account of supplies from the atmosphere furnished or withheld by nature.

In another and more practical point of view, the loss incurred by exhausting may be plainly exhibited. According to my views, soils supposed to be properly constituted as to mineral ingredients do not demand, for the maintainig and increasing of their rate of production, more than the resting, or the growth of two years in every five, mainly to be left on the land as manure.

These are the proportions of the five-field rotation, now extensively used on the most improving parts of Virginia. And one of these two years the field is grazed, so that parts of its growth of grass are consumed, instead of all remaining on the field for manure. To meet the same demands, the more Southern planter might leave his field to be covered by its growth of weeds (or natural grasses) one year, (and also to be grazed,) and a broadcast crop of pea-vines to be ploughed under in another, for every three crops of grain and cotton. But the ready answer to this, (and I have heard it many times,) is, "What! lose two crops in every five years? I cannot afford to lose even one." It may be that the planter is so diligent and careful in collecting materials for prepared manure that he can extend a thin and poor application, and in the drills only, over nearly half his cotton field; and perhaps he persuades himself that this application will obviate the necessity for rest and manuring crops to the land.

The result will not fulfill his expectation. But even if it could, the manuring thus given directly by the labor of the planter is more costly than if he would allow time and opportunity for nature to help to manure for him; whether alone, or still better if aided by preparing for and sowing the native pea, to the production of which your climate is so eminently favorable. All the accumulations of leaves raked from the poor pine forest, with the slight additional value which may be derived from the otherwise profitless maintenance of poor cattle, will supply less of food to plants, and at greater cost, than would be furnished by an unmixed growth of peas, all left to serve as manure.

The native or Southern pea, (as it ought to be called,) of such general and extensive culture in this and other Southern States, is the most valuable for manuring crops, and also offers peculiar and great advantages as a rotation crop. The seeds (in common with other peas and beans) are more nutritious, as food for man and beast, than any of the cereal grains. The other parts of the plant furnish the best and most palatable provender for beasts. They may be so well made in your climate, as a secondary growth under corn, that it is never allowed to be a primary crop, or to have entire possession of the land. It will grow well broadcast, and either in that way, or still better if tilled; and is of an admirable and cleansing growth. It is even better than clover as a preparing and manuring crop for wheat. In one or other of the various modes in which the pea-crop may be produced, it may be made to suit well in a rotation with any other crops. Though for a long time I had believed in some of the great advantages of the pea-crop, and had even commenced its culture as a manuring crop, and on a large scale, it was not until I afterwards saw the culture, growth, and uses in South Carolina, that I learned to estimate its value properly, and perhaps more fully than is done by any who, in this State, avail themselves so largely of some of its benefits. Since, I have made this crop a most important member of my rotation, its culture, as a manuring crop, has now become general in my neighborhood, and is rapidly extending to more distant places. If all the advantages offered by this crop were fully appreciated and availed of, the possession of this plant in your climate would be one of the greatest agricultural blessings of this and the more Southern States. For my individual share of this benefit, stinted as it is by our colder climate, I estimate it as adding, at least, one thousand bushels of wheat annually to my crop."

I can add nothing to what is said above.

I am, Colonel, very respectfully yours, etc.,

H. M. POLK.

Boliver, Hardeman county, Tennessee.

APPENDIX.

APPENDIX.

SCHEDULE OF QUESTIONS SENT OUT AND ANSWERS RECEIVED.

No.	Names of Correspondents.	Post Offices.	Counties.
1	Geo. T. Allman	Cornersville	Marshall
2	A. Kerr	White Bluff	Dickson
3	A. W. Hawkins	Huntingdon	Carroll
4	Tyree Rodes	Wales Station	Giles
5	E. D. Hicks	Nashville	Davidson
6	J. A Campbell	Murfreesboro	Rutherford
7	E. O. Nathurst	Tracy City	Grundy
8	Col. H. L Douglass	Woodstock	Shelby
9	W. T. Garrett	Manchester	Coffee
10	O. P. Butler	Fountain Head	Sumner
11	T. O. Harris	Saundersville	Sumner
12	W. H. Caldwell	Rives Station	Obion
13	J. A. Turley	Cog Hill	McMinn
14	Tom Crutchfield	Chattanooga	Hamilton
15	W. P, Gant	Columbia	Maury
16	G. W. Boyd	Wayne Furnace	Wayne
17	R. P. Fickle	Blountsville	Sullivan
18	J. Nat Lyle	Dandridge	Jefferson
19	W. G. Shields	Clinchdale	Grainger
20	R. F. C. Smith	New Middleton	Smith
21	L. P. McMurry	Trenton	Gibson
22	W. F. Lenoir	Philadelphia	Loudon
23	Jno. M Meek	Strawberry Plains	Jefferson
24	Ephraim Link	Greeneville	Greene
25	E. Y. Salmon	Lynchburg	Moore
26	J. T. Allman	Erin	Houston
27	Thos. W. Jones	Friendship	Dyer
28	W. H. Killebrew	St. Bethlehem	Montgomery
29	P. A. Mitchell	Jasper	Marion
30	Jno. T. McClellan	Montrose	Smith
31	C. A. Hunt	Hunts Station	Franklin
32	Jno. F. Hauser	Gruetli	Grundy

No.	Names of Correspondents.	Post Office.	Counties.
33	Jno. F. Baxter	Lynchburg	Moore
34	T. E. Abernathy	Buford	Giles
35	Mark S. Cockrill	Nashville	Davidson
36	L. F. Leiper	Witts Foundry	Hamblen
37	Sa ul. McRamsey	Vervilla	Warren
38	Thos. G. Moseley	Bell Buckle	Bedford
39	J. C. Marley	Ripley	Lauderdale
40	H. C. Anderson	Carolina	Haywood
41	E. F. Sharp	Ten Mile Stand	Meigs
42	Jno. T. Brown	Obion Station	Obion
43	H. B. Clay	Rotherwood	Hawkins
44	J. K. P. Wallace	Andersonville	Anderson
45	C. W. L. Mole	Liberty	DeKalb
46	J. F. Young	Double Bridges	Lauderdale
47	E. G. Seawell	Lebanon	Wilson
48	J. B. Richmond, M.D.	Baird's Mills	Wilson
49	Michael Hoover	Viola	Coffee
50	H. H. Norman	Murfreesboro	Rutherford
51	Robt. P. Rhea	Bluntville	Sullivan
52	Saml. Smith	Whitesbury	Hamblen
53	R. B. Hurt	Jackson	Madison
54	Campbell Brown	Spring Hill	Maury
55	B. F. Tillman	Henderson	Madison
56	James T. Pope	Stephens' Chapel	Bledsoe
57	A. G. McDougal	Savannah	Hardin
58	H. Skeeggs	Maynardville	Union
59	A. B. Cummings	Jonesborough	Washington
60	Jno. P. Jopling	Purdy	McNairy
61	Daniel Haynes	Haynes	Union
62	Robt. C. Nall	Tiptonville	Lake
63	W. H. Nelson	White Haven	Shelby
64	J. Alley	Walnut Valley	Sequatchie
65	W. P. Smallwood	Paris	Henry
66	J. M. Noblett	Boonville	Lincoln
67	T. J. Gregory	La Fayette	Macon
68	B. F. Cockrill	Nashville	Davidson
69	D. R. Hankins	Lebanon	Wilson
70	J. M. Graham	Pine-wood	Hickman
71	C. A. McDaniel	Fayetteville	Lincoln
72	J. T. Trapp	Smithville	DeKalb
73	Thos. S. Myers	McMinnville	Warren
74	David M. Scott	Decaturville	Decatur
75	J. A. Green	Ooltewah	James
76	Wm. Owen	Jasper	Marion
77	Jos. R. Mosby	Somerville	Fayette
78	R. F. McDonald	Smith's X Roads	Rhea
79	M. G. Gholston	Clarksville	Montgomery
80	Richard Hughes	Johnson City	Carter
81	James M. Head	Gallatin	Sumner
82	L. Howard Bell	Howard Springs	Cumberland
83	H. B. Greenwood	Sweetwater	Monroe

No.	Names of Correspondents.	Post Offices.	Counties.
84	J. B. Fancher	Fancher's Mills	White
85	Joshua Good	Black Wolf.........	Scott
86	Hamilton Hord.........	New Canton........	Hawkins
87	I. M. Stublefield	Shady Hill	Henderson
88	W. C Trice............	Henderson Station...	Henderson
89	Erby Boyd	Benton	Polk
90	Joshua Davis...........	Sneedville	Hancock
91	Louis Williams	Newbern...........	Dyer
92	John J. Boon...........	Jackson............	Madison
93	J. E. Washington	Cedar Hill..........	Robertson
94	L. Cooper..............	Coal Field..........	Morgan
95	J. S. Lindsay...........	Jacksboro	Campbell
96	H. H. Matlock	Riceville	McMinn
97	Thos. W. Roane........	Covington..........	Tipton
98	H. H. Ingersoll.........	Greeneville..........	Greene
99	Elijah Dority...........	Baker's Gap	Johnson
100	H. M. Polk............	Bolivar	Hardeman
101	Wm. Williams	Edgefield..........	Davidson
102	David McCroskey.......	Cleveland	Bradley
103	James Lamon...........	Harrison	James
104	W. G. Ewin............	Hurricane Mills.....	Humphreys
105	T. W. Edwards.........	Linden.............	Perry
106	R. A. Salsbury..........	Stewart	Houston
107	J. C. Murphy...........	Sevierville..........	Sevier

QUESTIONS AND ANSWERS.

What grasses are found most abundant in your ranges or highway pastures? If a variety, give the month in which each flourishes? (Sedge grass, broom sedge and old field sedge are only names for the *andropogons*—a true grass, not a sedge).

1 Nimble will, crab grass, broom grass, and a sprinkle of blue grass.
2 The natural grasses; crab grass makes a good hay; wild pea vine.
3 Great variety; cannot answer definitely.
4 Blue grass in fall, winter and spring; fox tail and crab grass in summer.
5 Can't name any except nimble will a late grass.
6 Blue grass is found everywhere it has a chance to grow.
7 Peas and some varieties of blue grass.
8 Nimble will and sedge grass, spring, wire grass and many wild grasses.
9 Sedge grass burnt off early, abundant in June.
10 Swamp grass in winter, the rye barren grass are the most prevalent.
11 Blue grass and white clover all the year.
12 Blue grass on high and nimble will on low; some cane and pea vine.
13 Sedge grass and blue grass are taking hold in some places.
14 Sedge grass and white clover, as also a small yellow clover plant.
15 We have no ranges or highway pastures.
16 The range here is excellent, with a great deal of wild grasses the year round.

17 Blue grass and sedge the most common; grows early and late; sedge too common and ought to be killed out.

18 Not much of any; blue grass is inclined to grow spontaneously.

19 Blue grass flourishes best in early spring, summer and autumn.

20 Nimble will, summer, blue grass and white spring clover.

21 Nimble will most abundant and most nutritious in the fall when the seed ripens.

22 Sedge.

23 A variety of wild grasses, some blue grass.

24 Blue grass, crab grass, sedge grass.

25 None of any value.

26 The out growing grasses are most flourishing in May, June and July.

27 Nimble will is the best, puts up in the spring and lasts through the summer.

28 Along highways blue grass is common, nimble will in creek bottoms.

29 Mountain grass, one variety, know no name for it.

30 Blue grass most abundant, flourishes all the year except when the ground is frozen

31 Something like the sedge; there are two or three kinds.

32 Cannot tell the names.

33 Nimble will in May.

34 Blue grass grows both along the highways and creek bottoms; white clover next.

35 White clover and blue grass, white clover, first July; blue grass all the year except July and August.

36 Very little grass grows outside of enclosures.

37 Sedge grass has been, but is rather giving way to red clover, which lasts from May to October.

38 Blue grass, almost universally.

39 Nimble will, pea vine and swamp grass, that puts up early.

40 Nimble will and other coarse, useless grasses only good when young and tender.

41 Our wild grasses grow from April to October.

42 Nimble will, a very fine grass, nutrititious till frost.

43 Our ranges have a tough wire grass and pea vine, also broom sedge.

44 Our ranges are principally under brush, huckleberry and wild grasses.

45 Blue grass in spring, and nimble will in summer

46 What is known here as yard or goose grass, nimble will on rich land.

47 Blue grass spring and fall.

48 Blue grass, white clover, nimble will and a tough grass that grows finely in the cedars.

49 Barren grass, which affords an abundance grass from April to 15th of July.

50 Blue grass is becoming thick on our highways.

51 Sedge grass in April and May, if burnt early; blue grass.

52 Crab grass in June and July, sedge grass July and August.

53 Nimble will is a fine summer and early fall, grows on rich bottom lands.

54 Much the same as above.

55 Sedge grass, and what is called here, Japanese clover.

56 We have a variety of grasses on our mountains which flourish well all summer.

57 Nimble will, sedge grass and barren grass.

58 No grasses unless cultivated.

59 But little range on our highways, 90 per cent. of the land enclosed.

60 All kinds there being good grasses on the ranges throughout the year.

61 Grasses abundant on the mountains in May and June.

62 Quite a variety, blue grass in April and May, nimble will in August and September.

63 No grasses of any value are found unenclosed except in limited areas.

64 Sedge grass flourishes all summer.

65 Nimble will grows along the creeks in summer and fall; do not know the names of the other.

66 Blue grass.

67 Sedge grass.

68 Blue grass; all enclosed, orchard in early spring, blue grass in the fall.

69 Blue grass; this grass has taken the place of all others.

70 Am not acquainted with the names; barren grasses in summer; beggar lice fall.

71 Nimble will, crab grass on lime soils, sedge on the ridge or barrens.

72 Crab grass, nimble will; blue grass flourishes in May.

73 Broom sedge, mountain sedge, rowine, nimble will in the coves of the mountains.

74 There are various wild grasses, but know no particular names.

75 Sedge grass, beggar lice; sedge fine from April to July.

76 Broom sedge from April till frost.

77 We have a variety of grasses which I cannot name; blue grass and white clover are among them.

8 I do not know any name except mountain grass which is most abundant from April 15, to frost.

79 Blue grass in some parts of the county, in other sections a grass resembling prairie grass.

80 Sedge grass

81 Blue grass has possession of the most of our highways; white clover in the spring and summer.

82 About a dozen different kinds; cannot give their botanical names.

83 Old field sedge; no native grass; cattle on the highways feed upon leaves and buds.

84 Different kinds of sedge, principally broom sedge, flourishes in June.

85 Pea vine in September and October.

86 Chiefly blue grass.

87 Sedge grass, barren grass and a few other wild grasses.

88 Sedge, and what we call nimble will; sedge best in early spring.

89 Sedge grass from April to October.

90 Blue grass from April to June; red top the same.

91 A coarse grass known as barren grass.

92 It is very difficult to answer this, as the wild grasses have no established names.

93 Broom sedge, June and July.

94 A grass much resembling sedge, with a broader blade, flourishes all the season.

95 Sedge grass best in spring and early summer; we have a kind of Savannah grass, that is very early.

96 Sedge.

97 Goose or yard grass from March to July, nimble will, a superior grass, very much like blue grass, lasts from April to frost.

98 Sedge grass, March to June; wild blue grass; perennial.

99 The mountains bordering our counties adjoining N. C. & Va. afford fine grazing; the bald places producing blue grass and white clover, and many kinds of valuable wild grasses, exceedingly nutritious, and flourishing all summer.

100 Crab grass from May to November, broom sedge and a variety unknown to me. Within the last few years blue grass has begun to make its appearance, and lespedeza stritata (worthless,) is covering the unworked commons.

101 White clover and blue grass in early spring; crab grass and nimble will in summer.

102 Sedge grass, both in enclosed and timbered land is the prevailing grass.

103 Wire grass and sedge, these are invincible and answer for general use.

104 A weed grass, the name of which I do not know.

105 I am not familiar with the names of grasses, depends much on the seasons.

106 Sedge grass, blue grass, white clover are coming up through the timber.

107 Clover and herds grass, or brown sedge burnt off in early spring.

What grasses are sown for pastures, and which do you consider the best for that purpose?

1 Blue, orchard, and other grasses. Blue grass first, orchard second.
2 Very few pastures sowed. Those that are, generally mixed grasses.
3 Red-top, clover and orchard grass. White clover grows spontaneously.
4 Orchard grass, blue grass, herds grass and clover. Blue grass best.
5 Blue grass, orchard and herds grass. Blue grass best.
6 Blue grass, orchard and herds. Timothy and clover best.
7 Clover and herds grass.
8 Orchard for timbered land. Herds on marshy lands. Timothy on rich up lands.
9 Blue and orchard grass. Blue in the western part of the country,
10 Blue grass and red-top, orchard grass.
11 Clover, blue and orchard. Blue the best. All should be sown together.
12 Clover is mostly used. I consider blue grass the best the season round.
13 Red-top, orchard and blue grass. The last two the best.
14 Clover, orchard, timothy, herds. Clover and orchard best.
15 Orchard, blue and clover. Orchard for open fields and wood land.
16 Clover. Clover the best.
17 Clover and blue grass. Cock's foot on uplands, Randall and red-top on wet lands.
18 For high land, timothy and clover, mixed. For bottoms, herds and clover.
19 Blue grass and orchard. The latter the best. Also red-top and clover.
20 Blue grass, orchard, red-top and clover.
21 Clover, red-top and orchard. Each good in its season.
22 Clover, herds, blue and timothy. Orchard is coming into use, and as far as tried, is thought best of all.
23 Orchard, clover and timothy. For permanent pasture, orchard the best.
24 Clover most. Lately, orchard grass is receiving much attention, it and late meadow oat grass mixed are superior to any others.
25 Blue grass and orchard grass.
26 Timothy and herds grass considered the best.
27 Timothy, herds grass, clover, millets, corn fodder, sheaf oats and and corn. I prefer timothy for roughness.
28 Clover, herds and orchard grasses Clover and orchard best for grazing.

29 Orchard, herds grass and clover. Orchard grass best.

30 Blue, herds and orchard grasses, clover. Blue grass much the best, though orchard does well on lands partly timbered.

31 Red-top, clover, orchard. Clover mostly sown for orchards.

32 Red clover, orchard and red-top. Nos. 2 and 3 best.

33 Blue grass and orchard.

34 Clover, blue grass, herds grass and orchard. The best in the order named.

35 Blue grass, clover and orchard. Blue grass for winter, clover and orchard for summer

36 Red clover, orchard and timothy mixed.

37 Clover, red-top and millet. Clover best for three months. Red-top preferable for the whole season.

38 Blue grass, orchard. Herds grass for permanent pastures.

39 Herds grass, clover, timothy. Herds grass and clover best.

40 Clover, herds and orchard grass.

41 Herds grass, orchard and timothy. All good.

42 Red clover, timothy, herds, blue grass. Clover and orchard best.

43 Orchard, Randall, blue grass, timothy, clover, herds grass. The first three the best.

44 Clover.

45 Clover, blue, orchard Think clover and orchard the best.

46 Orchard, herds, timothy and clover. I like a mixture of all the above. Alone, clover makes more feed while it lasts.

47 Blue and orchard grass and clover.

48 Blue and orchard the best. Herds makes a fine clover.

49 Clover and herds grass. I consider clover the best.

50 Clover, blue grass and some orchard. A liberal quantity of each, best for pastures.

51 Timothy, clover, orchard, Randall, blue and red-top perhaps the best.

52 We have three grasses that we use for pasture, clover, timothy and blue grass. Orchard is being introduced.

53 Orchard and red-top combined, is generally preferred. I prefer clover and timothy.

54 Clover, blue, orchard and red-top. Could not do without either. Blue grass probably the best.

55 Clover, orchard, blue grass and red-top. A mixture of all these I think best for pastures.

56 Clover, timothy, red-top, blue grass, orchard. Clover makes the best.

57 Clover and orchard grass.

58 Red-top, clover, orchard, and ever-green grasses.

59 Orchard grass and dog foot are preferable for grazing purposes.

60 Herds and orchard grasses and red-top.

61 Clover, timothy, orchard and blue grass. All good for pasture.

62 Clover, orchard and blue grass. Three or more mixed

63 Orchard, red-top for winter. Rye, oats, crab-grass grazed in summer.

64 Clover and orchard grass thought to be best.

65 Red clover, orchard and herds grasses.

66 Blue and orchard.

67 In the southern portion of the county blue grass, and upon the thinner soil, herds grass and sedge grass.

68 Orchard. blue and red-top grasses, on low lands, especially where damp.

69 Blue grass, orchard, clover and red-top. Best, blue grass; second, orchard; third, clover.

70 Red clover, white clover, orchard and blue grass. I prefer a mixture of all.

71 Blue grass and orchard for permanent pastures, and clover for summer.

72 Blue, herds and orchard grasses. Blue the best for pasture.

73 Herds grass and clover, also blue and orchard. The first two best for use.

74 Herds grass.

75 Clover, herds. Blue and orchard grasses are very good.

76 Orchard, clover and red-top Orchard has no equal for pasture.

77 None except to a limited extent. Clover and red-top mixed does well, orchard better.

78 Timothy, herds grass, clover, orchard and blue grass. The best is a mixture of the three first.

79 Clover, red-top and orchard. Orchard grass the best.

80 Timothy and herds grass. The former is regarded best.

81 Blue grass, orchard and clover. Blue grass best.

82 Same as above, (red-top, timothy, clover)

83 Clover, red-top and orchard.

84 Clover, herds grass. Occasionally orchard.

85 All kinds of grass, except millet, Hungarian and clover.

86 Timothy, orchard, Randall and herds grass mixture of all.

87 Herds grass, orchard and clover. Clover and orchard best.

88 Herds grass, orchard and timothy. Best, herds grass; second, orchard.

89 Red-top, clover, orchard grass. Orchard the best.

90 Blue grass or orchard and clover.

91 Red clover, herds grass, orchard, blue grass. Best, clover, mixed with red-top or orchard.

92 Orchard and blue grass.
93 Blue grass, orchard, clover and red-top. Orchard the best pasture.
94 Clover and red-top are all that is used in this county. Clover the best, if it would last.
95 All the common grasses are used for grazing. Clover and orchard best.
96 Clover, red-top, orchard grass. Orchard best.
97 Herds grass, clover, timothy. The last two mixed with orchard. For permanence, herds, timothy, orchard.
98 Blue grass, orchard and herds grass.
99 Blue grass, red-top and red clover. All considered good. Blue grass best.
100 I consider the only way to have a good and permanent meadow or pasture, is to sow a mixture of grasses, the more the better, and a good sod will scarcely be formed under 10 or 15 years.
101 Blue and orchard grass and clover.
102 Orchard and herds grass.
103 Blue grass.
104 Orchard, timothy and herds. Orchard makes the best pasture.
105 Herds grass and orchard. The latter preferable.
106 Millet and Hungarian, blue grass and red-top.
107 Clover. Have just commenced with orchard, but believe it to be good.

Please mention what character of soils these grasses flourish best upon?

1 Blue grass on lime-stone soil, orchard on all our lands.
2 On creek alluvial bottoms, and red clay subsoil, uplands.
3 Loamy uplands or bottoms.
4 All the above grasses flourish best on creek bottom lands. Herds on wet land.
5 Blue grass requires lime-stone soil. Orchard shade. Herds anywhere.
6
7 Millet and herds grass do well on best of mountain land.
8
9 Herds grass, clay soil. Orchard does well on the same.
10 Red-top on swampy land. Blue grass on rich loamy land.
11 Lime-stone land for blue grass; clover and orchard grass adapted for all soils.
12 On high lands Poplar and hickory growth for clover and blue grass; low lands for red-top and timothy.

13 Orchard and blue grass for shaded lands. Red-top for damp, cold lands.

14 The above grasses grow well on both bottom and uplands.

15 Clover on any of our soils. Millet and herds require a better soil than clover.

16 Red-top and Randall, wet or damp land. Clover, blue grass, dog-foot and timothy uplands and well drained land.

17 Black slate or lime-stone. Almost all the land of this county will do.

18 Limestone and the best character of clay soils.

19 Red-top on wet lands. Blue grass, clover and timothy on lime-stone.

20

21 Clay loam.

22 Timothy and herds grass on flat, wet lands; other kinds, clay and alluvial soils.

23 Bottom for timothy and red-top. Limestone land for orchard and clover.

24 On compact clay soil. Mulatto, if not too low and porous.

25 Blue grass on limestone. Orchard on poplar land.

26 Good upland, but I think bottom land is better.

27 Timothy does best on rich uplands. Herds on bottom or flat land.

28 On any having red clay subsoil.

29 Orchard and clover on dry alluvial soil. Herds on low tight soil.

30 They do well on any soil not worn out though best on hill side.

31 Red-top does best on low swamp land. The others require better soil.

32 A porous sandy soil mixed with lime and underlaid with clay.

33 Limestone and poplar land.

34 Clover, blue grass and orchard on all lime soils. Herds on most bottom lands.

35 Limestone soil with red clay subsoil.

36 Rich clay soils. Timothy and herds grass do best on level land along water courses.

37 Clover does well on any good soil. Red-top does best on bottom land.

38 On any of our limestone soils not too much worn out.

39 Low lands are best for herds grass and timothy; uplands for millet and corn.

40 Rich bottom loam, but clover succeeds well on high land with good soil.

41 Herds grass on low, clover on high, timothy on both.

42 Clover and orchard best on black loam. Herds on bottom lands.

43 The limit of this space will not admit.

44 Any kind not too much exhausted.
45 Blue grass is best on north land, and orchard on south land.
46 We have no soil in our county that they do not do well upon, unless too poor or too wet.
47 Blue grass and clover do best on rich limestone soil. Orchard grass will flourish on any soil.
48 Clover, orchard, blue and herds grasses on upland; timothy on flat or creek land.
49 A low wet soil suits herds grass, but it will flourish on any kind of soil.
50 A good upland with clay subsoil. Blue grass loves plenty of lime in the soil.
51 Randall and red-top on wet moist land.
52 Tight clay soil. The land that gets the muddiest in the winter is the best.
53 Our best uplands. Red-top will do well on lands subject to overflow.
54 Our rolling limestone lands seem best.
55 What we term second bottoms, just above the overflow, best for herds grass.
56 Clay land and black stiff limestone. Red-top does well on low sandy soil.
57 For clover, good upland, well manured. For orchard, rich light soil, well cleaned.
58 Low or wet lands. If high lands, clay or limestone lands, best.
59 What we call dark mulatto uplands and creek bottoms.
60 Damp clay soil for herds; clover grows well on any except sandy soil.
61 Clover on black lime land. Timothy on gray alluvial soil.
62 Clover and blue grass on clay. Orchard on a mixed loam.
63 Orchard on our uplands, partially shaded. Marshy land for red-top.
64 Clay soil impregnated with lime.
65 Clay or stiff land.
66 Black land.
67 Blue grass and herds are best upon rich soil. Large grass best upon poor soil.
68 Limestone with clay understrata for the three named above.
69 Bottom lands with the greatest quantity of lime in it.
70 Rich uplands or second bottoms.
71 Blue grass does best on stiff lime soils. Orchard on loose shaded soil.
72 Black low lands, but grows well on most lands in the county.
73 Limestone land for timothy and blue grass. Herds grows anywhere.

74 Herds grass grows well on rather wet lands, but will grow on uplands
75 Yellow dark uplands and bottom lands; grows fine on our uplands.
76 On all limestone soils of the valley.
77 Most of the soil of this county is alluvial, resting on a good clay subsoil, and is well adapted to all the grasses.
78 Upon limestone land that is very close and gets hard.
79 Timothy does best on rich creek and river bottoms, intermixed with but little sand.
80 They grow well on all uplands.
81 Limestone with a good clay foundation.
82 Sandy loam. Clay loam. The first for clover only.
83 Red-top on low marshy; clover on tight clay subsoil, mulatto loam.
84 Herds grass on sand; clover on red clay lands; orchard on corn land.
85 Low river bottom for millet, Hungarian and clover.
86 All alluvials not too sandy, and limestone clays.
87 Clay lands that are not much worn.
88 Herds grass on low damp. Orchard on tight loam.
89 Well drained rich clay lands.
90 On limestone or low land, when the soil is good
91 All of our soils are clay loam on which all the above grasses do well.
92 Dark soils with yellow clay subsoils, and rather moist.
93 The three first flourish on our lands generally, but red-top is the best for thin or worn land.
94 Clover on clay and mulatto land. Red-top on black sandy land
95 Limestone soil is best for timothy and clover. Herds grass does well on lighter soil and sandstone.
96 Red-top will grow anywhere. Orchard best on rich soil Clover almost anywhere by using plaster.
97 Alluvial and moist. Herds does well on old, worn, clay hill sides, if started by fertilizers
98 Tight close soils; especially clay bottoms.
99 Limestone soils and all clay soils that are rich. None of our sandstone ridges or soils are good for grasses.
100 In West Tennessee they flourish on lands with good clay foundations; do badly on porous sandy soils.
101 Rich loam with clay underneath.
102 Orchard grass best on mulatto land. Herds on low damp land.
103 They do very well on limestone, but better on alluvial soils.
104 Timothy and herds grass do best on low wet lands. Orchard does well anywhere.
105 Our best upland soils for orchard, and good bottom lands for herds.

106 Seem to grow well upon most any soil.
107 A whitish clay, thin knob lands, that is, rough and slaty or close mulatto.

What kinds of hay or feed, other than grasses, are used during the ploughing season, and which do you consider the best?

1 Mostly corn blades. Some feed oats. No better feed for horses.
2 Fodder and corn, with clover and timothy for a change. Hay and oats best fodder.
3 Corn fodder, corn, red-top and millet hay.
4 Corn fodder, clover, herds grass and timothy. Corn fodder best.
5 Corn fodder and timothy, or herds grass. Timothy and herds grass hay.
6 Grain and hay. A change of oats, wheat-bran best with plenty of hay.
7 Timothy hay.
8 Corn fodder and oats, timothy and red-top hay. Hay and oats preferable.
9 I consider well-cured fodder the best food for horses in warm weather.
10 Oats and corn fodder. Clover hay is the best food for all purposes.
11 Such hay as may be on hand. Nothing better than corn and clover hay.
12 Corn shucks and oat straw cut up and mixed with meal, is good. Oats the best.
13 All the different kinds of hay, corn and oats. None better than clover and orchard grass mixed.
14 Millet and other hay with fodder and oats. Red-top and timothy with fodder, best.
15 Oats and fodder are both used, but oats are the best.
16 Fodder. I prefer good clover and herds grass hay.
17 Mixed feed. Cut oats, hay and millet with some corn. Food not too much varied, best for health.
18 Corn fodder, wheat straw.
19 Corn, oats, blade fodder. Consider oats chopped, best.
20 Corn fodder, oats, Hungarian and German millet.
21 Corn blade fodder is principally used, and generally considered best.
22 All ordinary kinds of hay, corn and oats. Oats and clover hay best.

23 Clover and timothy is best. Corn fodder, shucks, straw and sheaf oats.

24 Corn fodder, millet, sheaf oats and meal together, too often corn alone.

25 Clover, oats and fodder.

26 Corn and corn fodder mostly used in the ploughing season.

27 Timothy, herds grass, clover, millet, corn fodder, sheaf oats.

28 Oats and fodder, millet, oats, best. Fodder from corn next in value.

29 Clover, herds grass, timothy, orchard. Clover and timothy.

30 Corn, clover, oats and ship-stuff. Corn and oats best.

31 Clover and millet, some red-top. Corn fodder.

32 Timothy, red-top and millet. Nos. 1 and 2 best

33 Oats and fodder.

34 Soiling with red clover and rye. Clover best.

35 Clover, timothy and millet and corn fodder while on hard work.

36 Chopped feed, mixed with rye or corn meal, with plenty of hay.

37 Corn fodder.

38 Very rare to find any one using anything but hay except a little fodder.

39 Fodder and oats. Consider oats best.

40 Clover hay, millet and Hungarian, herds grass. The first and last best.

41 Hay made of all the grasses, with corn fodder. Timothy best.

42 Timothy, clover, millet. Timothy considered best.

43 Timothy, herds grass and clover hay and fodder. Timothy and clover aré the best.

44 Corn fodder.

45 Corn fodder and oats. I think timothy the best for anything.

46 Corn, oats, and occasionally bran and corn mixed

47 Oats and corn fodder, with corn. Fodder considered best.

48 Fodder, oats, German millet and Hungarian grass. Oats and Hungarian decidedly best.

49 Corn fodder and oats. I consider corn and oats best.

50 Clover hay, German millet, some timothy and herds grass and Hungarian.

51 Cut oats with wheat bran, corn, mixed feed best.

52 Chopped feed, straw or oats cut up with meal or bran.

53 Principally fodder.

54 Timothy, clover, German millet, Hungarian, red-top. I think clover best.

55 Corn fodder. I think that hay made from timothy and herds grass decidedly preferable.

56 Oats and fodder are used aside from the grasses, and are, by some, considered the best feed.
57 Corn and fodder. Fodder regarded better than hay.
58 Millet, Hungarian and clover.
59 Oats, corn and millet. Principally oats and corn, with hay.
60 Sheaf oats, maize fodder. Either of which is good.
61 Timothy and clover I consider best. Oats, rye and wheat chop.
62 Corn fodder and sheaf oats—cut oats.
63 Oats in sheaf, pulled fodder, cut corn fodder and stalks.
64 Corn fodder. German millet is used considerably.
65 Corn fodder.
66 Hungarian and timothy.
67 Oats, fodder and corn. Corn and oats considered best.
68 Oats first cut in straw, fodder, Hungarian. Oats best by all means.
69 Oats and corn fodder. Also, timothy, orchard grass, clover, red-top. Oats best, second, clover.
70 Leaving out clover, we prefer corn, oats and corn fodder.
71 Millet and Hungarian and clover. Clover best, Hungarian second.
72 Corn fodder and clover hay.
73 Corn fodder is the equal of any feed, and much used in ploughing time.
74 Fodder and oats.
75 Clover, millet, oats. We use various other kinds.
76 Clover, orchard grass, red-top, timothy, millet. The four first are all very good.
77 Corn fodder is our chief reliance. Rye in its green state, is convenient and profitable.
78 Timothy, herds grass and clover, fodder and millet. Timothy best.
79 Corn fodder and shucks.
80 Clover, oats and millet. Oats regarded as best.
81 Corn, oats, fodder, pea-vine. Corn with fodder, or oats alone.
82 Red-top hay, natural meadow hay, straw, millet, sheaf oats. I like red-top hay with corn.
83 Timothy, clover hay, some fodder. Timothy does not slobber or heat.
84 Herds grass, and other hays and corn fodder best. Herds at night, fodder, morning.
85 Corn, oats, fodder and rye.
86 Millet, fodder, sometimes shucks or straw.
87 Herds grass, fodder and millet.
88 Herds grass, millet, clover and fodder. Herds grass and clover.
89 Fodder, shucks, straw and hay. Timothy hay the best.
90 Clover hay. Some are using millet.
91 Oats and corn fodder. Oats preferred.

92 Oats and corn fodder, commonly used. Oats cut up with the straw is best.

93 Oats and corn fodder. Oats is the best food next to hay.

94 Clover and blade fodder. Clover is reckoned the best, but red-top is as good.

95 Corn fodder and sheaf oats. Oats best.

96 Corn fodder. Nothing better than good hay.

97 Corn fodder, almost universally, shucks, oats, corn fodder.

98 Clover, millet, corn and oats. Clover the best forage.

99 Timothy, clover and red-top are considered best. Some grain is necessary to keep stock in good order.

100 Corn blades or fodder are almost universally used. Clover hay and herds grass are also used.

101 Fodder, oats in the sheaf, rye in sheaf and cut.

102 Herds grass, cut corn, corn fodder, wheat straw cut and mixed with rye and ground corn.

103 Clover principally.

104 Clover hay, herds grass hay, pea-nut vine hay for cows and sheep.

105 Fodder and corn husks. The former, when properly cured, the best.

106 Mostly blades from the corn.

107 Corn fodder and shucks.

What kind of hay are sheep and cattle fed upon in winter?

1 Clover, Hungarian and millet. Many, but little or none, of either.

2 Generally a little millet, but mostly on shucks and nubbins of corn.

3 Red top, millet and clover.

4 Herds grass, timothy, clover and millet.

5 Sheep fed but little—clover, timothy, herds grass, millet and hay.

6 Some feed clover (the best), others wheat straw, shucks and fodder, the next thing to nothing.

7 Herds grass and clover.

8 Cotton seed and shucks, and rarely that.

9 German millet for cattle, herds grass for sheep.

10 Clover and red-top.

11 Cattle on straw and corn stalks, sometimes hay and corn. Sheep rarely fed at all.

12 Clover, timothy and millet. Millet considered by good farmers poor feed.

13 Wheat straw and all kinds of hay.

14 Red top and timothy, Sheep relish the rag-weed well saved and stacked.

15 Timothy and red-top and clover hay, stalk fodder.

16 Clover and millet.

17 Sheep mostly fed on fodder. Sometimes on hay. Many run in the woods and on the commons.

18 Corn fodder, generally.

19 Clover and timothy, and largely on fodder.

20 Promiscuously.

21 All the different kinds of hay grasses.

22 Mostly wheat straw for cattle. Sheep make their living where they can.

23 Fodder stalks, straw, clover and timothy.

24 When not given corn fodder, clover preferred for cattle. Sheep: other hay or sheaf oats.

25 All kinds, especially timothy.

26 Clover and timothy in winter.

27 Shucks and cotton seed.

28 Clover and timothy.

29 Cattle fed mostly on shucks. Sheep, herds grass and fodder.

30 Millet and clover, shucks, fodder, wheat and rye straw.

31 All kinds. Wheat straw and chaff fed largely to sheep.

32 Clover, red-top and millet.

33 Clover and timothy and some pea hay for sheep, shucks and cotton seed for cattle.

34 Clover hay and corn fodder. Corn fodder cheapest.

35 Corn fodder and clover.

36 Clover and other hays, straw and shucks.

37 Corn fodder, red top.

38 Little hay fed to cattle, sheep eat no hay except there is some snow on the ground.

39 Shucks, cotton seed and wheat straw.

40 Clover hay, herds grass and German millet.

41 All the different kinds of hay, fodder and straw.

42 Timothy, clover, herds grass, fodder and straw of different kinds.

44 Wheat straw and corn husks.

45 Sheep are mostly fed on corn blades, cattle on shucks.

46 Hungarian and German millet and occasionally clover

47 Cattle mostly on cut corn stalks, beef cattle and milch cows on millet and timothy.

48 Clover, timothy and corn shucks, which are feed to cattle.

49 Herds grass and clover and German millet, which yields quite a large crop

50 Clover hay, German millet and wheat straw.

51 Timothy, clover, fodder, straw; sheep do well on blue grass pasture

52 Cattle are fed on cut corn and shucks, timothy hay. Sheep, fodder mostly.

53 Clover and timothy, recently the German millet is being sown, but I do not like it.

54 All mentioned, timothy, clover, millet, red top.

55 Principally corn fodder and shucks, as hay is not grown extensively enough to fed all stock.

56 Millet, clover and herds grass.

57 The above (millet, Hungarian and clover) are principally sown for winter feed and are the best.

58 Clover and corn fodder are considered the best.

59 Almost every kind, pea vines, wild grasses, corn husks, etc.

60 Timothy, clover. The most of them are grazed when there is no snow.

61 Very little of any kind

62 Clover, pea vines, cut corn stalks, but most persons do not feed them anything.

63 Mostly on red top and millet.

64 Clover, herds grass, shucks and wheat straw.

65 Those mentioned above (Hungarian and timothy).

66 Clover and millet.

67 Any of the kind mentioned, clover preferable for sheep and cattle, timothy for horses.

68 Clover, but a great many feed on corn stalks and fodder.

69 Not fed much at all, shucks, millet, wheat and rye straw, sometimes clover and oats.

70 Cattle are fed on wheat straw, millet and clover, hay and blue grass. Sheep are kept on blue grass. In cold weather corn or oats.

71 Clover, German millet, Hungarian and herds grass.

72 Corn fodder is the equal of any feed, and much used in plow time.

73 Herds grass, clover and millet, but quite a number feed straw of wheat and corn shucks to cattle, oats to sheep.

74 Clover and herds grass.

75 Principally upon clover, herds grass and timothy.

76 Shucks and straw, generally

77 I regret to say none. We give them cotton seed ad libitum, and the run of corn stalk fields, some graze on wheat.

78 Cattle are fed on corn shucks, straw and cut corn stalks, sheep graze on the grasses, wheat and oats.

79 Corn fodder, shucks and millet.

80 Herds, clover and timothy.
81 Clover is used more than any other, cut fodder.
82 Common meadow hay, red top.
83 Cattle mostly on shucks and straw. Sheep, fodder and fine hay, such as red top.
84 As a general rule nothing, but perhaps a little corn to the poorest.
85 All kinds generally.
86 Clover, timothy, herds grass, fodder, chopped straw with corn meal
87 Herds grass, clover and fodder, corn shucks for cattle.
88 Clover and millet.
89 Wheat straw and chaff.
90 Red top mostly, sometimes timothy.
91 Clover, wheat straw, and meadow hay generally.
92 Corn fodder and shucks generally Other hay to some extent.
93 Not much of any kind.
94 Millet, red top, clover and blade fodder.
95 All kinds of grass above mentioned.
96 Clover and red top, but mostly on wheat straw.
97 Herds grass, timothy, corn fodder, clean hay and shucks, but little of either fed to sheep.
98 All kinds.
99 Timothy, clover and red top are the kinds generally used.
100 Clover, herds grass, pea fodder, corn fodder, crab grass. They are fortunate to get any of these more frequently they live on wind and moonshine and die in March.
101 Clover, timothy, Hungarian and millet.
102 Cattle mostly on wheat straw and shucks. Sheep on fodder and hay.
103 Clover generally.
104 Generally on pea nut and clover hay.
105 On whatever kind we have on hand.
106 Very little of any kind. Corn and shucks and corn fodder.
107 I think fodder the best of anything.

Are highway or enclosed pastures most used in summer?

1 Enclosed pastures by best farmers.
2 Entirely highway or wood pastures. No enclosed pastures. There is sufficient forage in the woods.
3 Highways mostly, though many have enclosed pastures.
4 Enclosed pastures.
5 Mostly enclosed.
6 Highway generally. Some farmers have enclosed pastures.

7 On the mountain, the "highway," 100 miles wide.
8 Highway almost exclusively.
9 Highway to a great extent
10 Highway mostly used in the central part of the county; enclosed in the West.
11 Enclosed pastures.
12 A few years since highways were used, now enclosed are considered most profitable and best.
13 Highways, but our best farmers use enclosed pastures most.
14 By the masses, the highways.
15 Enclosed pastures; in my county all the lands are under fence.
16 Highways.
17 Much woods and commons. Not many fenced pastures.
18 Enclosed at present. This is a very thickly settled county.
19 By good farmers enclosed pastures, but many cattle run at large.
20 Enclosed pastures.
21 Formerly the highway was most used, but latterly enclosed pastures are coming into use.
22 Enclosed pastures, excepting in the most broken sections.
23 Both are used. The greater number turn on the highways.
24 Enclosed but much stock range out, especially along the mountains.
25 Enclosed.
26 Both. Highways most.
27 Highway. But few farmers keep up all their stock.
28 Enclosed pastures prevail.
29 Highway.
30 Highways mostly, though some farmers have fine pastures.
31 Enclosed mostly used here. Stock get along very well in some parts.
32 Highway or wild pastures through the timber.
33 Enclosed.
34 Enclosed except on the table-lands bordering on Lawrence county.
35 Stock farmers invariably enclose. General farmers use the highways
36 Enclosed pastures in the more fertile sections. In the hilly country they use the woods.
37 Enclosed.
38 Enclosed pastures entirely, except a few renters.
39 Highway or woodland.
40 Those who pay no attention to the grasses depend entirely upon the highways, but I consider them worthless for profit only in June and July.

41 Enclosed
42 Enclosed pastures for summer. Forests too dense to grow grasses.
43 Enclosed pastures.
44 Enclosed.
45 Enclosed pasture
46 Highway in the proportion of about seven to three.
47 Enclosed pastures.
48 Enclosed, though there are fine highway pastures in this county.
49 Highway.
50 Enclosed. Highway only used by tenants.
51 Enclosed.
52 Enclosed.
53 Highway.
54 Enclosed. This is a grazing county.
55 Highway, at least five to one.
56 Highway mostly used, some enclosed pastures
57 Highway.
58 Enclosed are entirely used.
59 Enclosed pastures.
60 Stock run upon ranges or pastures at all times.
61 Enclosed in my neighborhood.
62 Highway.
63 Highway.
64 Enclosed, though considerable stock run at large.
65 Enclosed pastures most used.
66 Enclosed.
67 Highway, except in the blue grass portion of the county.
68 Enclosed. Highways are relics of half civilization and indicate decay.
69 Enclosed pastures.
70 Highways.
71 Enclosed principally, except on the ridge.
72 Enclosed mostly, but highway pastures in some portions of the county.
73 Enclosed by good stock raisers, but many use the commons only.
74 Highways.
75 Highways.
76 Our mountain ranges are principally used.
77 Highways for the most part.
78 Highway or monutain region for cattle and sheep.
79 On south highway, north enclosed
80 Enclosed pastures generally.
81 Enclosed. But little highway pastures in this neighborhood.

82 Highways.
83 Enclosed. Our poor people let their stock run at large.
84 I suppose equally divided. The interest in enclosed pastures is growing.
85 Both are very generally used.
86 Enclosed. No *good* farmer would think of turning his stock out.
87 Highways mostly. Enclosed by our best farmers.
88 Both. Cattle and sheep run on highways.
89 Highway.
90 Clover and blue grass.
91 Enclosed, principally.
92 Comparatively few persons confine their stock in summer.
93 Highways, except when a good chance offers to run stock on other people's enclosures.
94 Highways nearly altogether.
95 Highway.
96 Highway.
97 Highways almost entirely.
98 Enclosed pastures.
99 Enclosed pastures are generally used.
100 When you speak of highway pastures I suppose you mean the bleak hills worn out by cotton. I am sorry to say here is where our cows get the wrinkles on their horns—marks of years of suffering.
101 Enclosed.
102 Highway or timbered land south of Cleveland.
103 Mostly highways.
104 Usually highways, or the range, as it is called here.
105 Mostly highways.
106 Highways
107 Small herds on enclosed pastures. Large herds are summered on the mountains.

Please mention the kinds of grasses, or forage plants, grown for hay in your county, and which are regarded as best.

1 Timothy, clover, herds grass. Preference given in the order named.
2 Clover and timothy with corn blades and goober pea hay, but mostly German millet.
3 Clover and red top, German millet; red top best.
4 Timothy, herds grass, clover, millet; clover the best.
5 Red clover, herds grass, timothy.

6 Clover, timothy, herds grass. German millet best. Timothy for horses.

7. Millet and herds grass.

8. Timothy, herds grass, clover, millet. Timothy and clover liked best.

9 Clover, herds grass, timothy, German millet, Hungarian grass.

10 Clover, herds grass, red top.

11 Timothy, clover, millet, Hungarian; clover and timothy best.

12 Clover, timothy, red top.

13 Red top, timothy and orchard grass Red top for wet lands, timothy for dry.

14 Clover, timothy, herds grass, millet; clover and timothy preferred by some; herds grass by others.

15 Timothy and red top; clover for meadows; timothy considered best.

16 Millet, herds grass and clover; herds grass preferred.

17 Clover, timothy and dog foot and Randall grass and the different millets, blue grass.

18 Timothy, herds grass and clover.

19 Timothy and red clover are considered the best; red top is also grown

20 Clover, red top, timothy.

21 Red clover timothy, herds grass and millet; clover and timothy best.

22 Clover, herds grass, orchard grass, German millet, timothy; in the order named.

23 Red clover, timothy, red top, orchard grass; red top and timothy.

24 Timothy, clover often mixed; herds grass on low land; timothy and clover mixed, the best hay.

25 Best in the order mentioned; clover. timothy, herds grass, German millet.

26 Clover and timothy hay is the best used in our county.

27 Red clover, timothy, herds grass, Hungarian and German millet.

28 Clover, timothy, oats, millet; clover, timothy and orchard grass the best hay.

29 Clover, herds grass, orchard grass and millet; clover for home use, herds grass for shipment.

30 Millet, timothy, red top and red clover; the best ones, clover and red top.

31 Clover, red top, timothy, orchard, millet and peas make good hay; clover best.

32 Blue grass, red top, orchard, clover, timothy and millet. Nos. 3, 4 and 5 best.

33 Clover, timothy, herds grass, Hungarian and millet.

34 Clover, herds grass, timothy and the millets, Missouri and German.
35 Clover, timothy, red top and millets, orchard; clover, red top and timothy mixed the best
36 Timothy herds grass, clover, orchard grass; timothy and herds grass the best.
37 Clover, red top, millet.
38 Clover, herds grass, timothy, orchard grass, millet; in the order named.
39 Herds grass, timothy, clover, peas, millet; herds grass considered best.
40 Herds grass, clover, timothy, millet, Hungarian; herds grass and clover last.
41 Timothy, herds grass, clover, millet; the first three the best.
42 Red clover, timothy, herds grass and millet; timothy and clover best.
43 Timothy, clover, herds grass; clover the best; timothy next.
44 Red top, timothy and clover; the latter makes the best hay.
45 Timothy, red top, clover and the different millets; timothy and clover the best.
46 German and Hungarian millets, herds grass, timothy and clover.
47 Clover, timothy, herds grass, German and Hungarian millets; timothy and clover the best.
48 Clover, red top, orchard and timothy; the first and last the best.
49 Clover, herds grass and timothy. I regard clover as being the best.
50 German millet and Hungarian grass, herds grass, timothy and clover. The last two combined the best.
51 Timothy best; clover next.
52 Clover, timothy and blue grass.
53 Clover, timothy and herds grass; orchard grass is becoming quite a favorite, especially for pasture. Clover and timothy combined the best.
54 Clover, timothy, herds grass, and to a small extent orchard grass.
55 German millet, clover, timothy, red top; timothy and red top mixed are the best.
56 Clover, timothy, red top and the millets; timothy best for hay; all do well.
57 Timothy, herds grass, clover and German millet.
58 Red clover, timothy and herds grass.
59 Timothy, clover, red top, millet; 1st, 2nd and 4th preferred
60 Herds grass, timothy, clover, millet; herds grass best.
61 Blue grass, timothy, clover, orchard grass; the three latter best for hay.
62 Clover, timothy, Hungarian and German millet, red top; clover and timothy best.

63 Timothy, clover, pea vines, crab grass large, coarse swamp grass called wild millet; best in the order written.

64 Clover, red top, timothy, orchard grass; red top and clover best

65 Red clover, herds grass, timothy.

66 Hungarian, timothy, herds grass, millet.

67 Hungarian, timothy, German millet, Missouri millet and clover; clover best.

68 Timothy, red top, clover; regard clover and timothy the best.

69 Best, 1st, timothy; 2nd, clover; 3d, orchard grass; 4th, red top; last and least, Tennessee and Missouri millet.

70 Clover, red top, Missouri and German millet and corn fodder.

71 German and Missouri millet, Hungarian and clover; clover best, Hungarian next.

72 Herds grass, timothy, clover, German millet, Hungarian.

73 Herds, clover, timothy, orchard, blue grass and the various millets.

74 Herds grass and clover.

75 Herds grass and timothy.

76 Clover, red top, timothy, orchard and millet. Best in order named.

77 Clover, red top, German millet, crab grass and the pea. Clover and red top considered best.

78 Timothy, herds grass, clover; orchard and blue grass the best.

79 Mostly the millet family; timothy and herds grass to a limited extent.

80 Timothy and herds grass. The first regarded the best.

81 Timothy red top, orchard and clover. Blue grass best for permanent pastures.

82 Red top, timothy, clover; value in the order written.

83 Clover and timothy; timothy hay is best; clover yields most.

84 Herds grass, millet, timothy, clover.

85 Millet, Hungarian, red top, timothy and clover.

86 Clover, timothy, herds grass millet, corn fodder.

87 Clover, herds grass, millet; clover the best.

88 German millet, herds grass, timothy; clover and fodder best.

89 Millet, herds grass, timothy, clover; timothy best for hay.

90 Red top and timothy best for hay.

91 Timothy, clover, red top, millet, crab grass, Indian corn. Best, timothy, clover, corn fodder.

92 Red top, blue grass, orchard, two or three kinds of millet, Hungarian; red top most reliable.

93 Timothy, clover, red top, German millet, Hungarian grass.

94 Clover, millet, red top; clover wont last on our land; millet kills the land; red top very nearly a natural growth.

95 Timothy, orchard grass, red clover herds grass; millet, timothy and clover best.

96 Clover, timothy, red top; timothy best where it can be grown.
97 Clover, herds grass; timothy, German millet preferred to Tennessee and Hungarian.
98 Clover, timothy, herds grass, orchard and blue grasses, millet.
99 Clover, timothy, red top and some millet; timothy considered best.
100 Clover, herds, orchard grasses, timothy, each grown and cut with clover; clover best; timothy dies out second year.
101 Timothy, herds and orchard grass, Hungarian and millet.
102 Herds grass, cut corn and corn fodder, some German millet.
103 Timothy and herds grass; blue grass is preferable to either.
104 Timothy, herds, orchard and clover German millet.
105 German millet and herds grass. The latter much the best.
106 Some clover, blue grass and red top.
107 Herds grass and clover. Am experimenting with timothy.

THE GRASSES OF TENNESSEE.

AN ESSAY BY B. F. COCKRILL, READ BEFORE THE TENNESSEE STOCK BREEDERS' CONVENTION AT ITS THIRD ANNUAL SESSION, FEBRUARY 19, 1878.

The vast field of study which this heading indicates is by far too extensive to be treated of in a paper like this, except in a cursory manner. I, therefore, shall not attempt to go into detail only to the extent of enumerating some of the more generally known varieties, and instituting a comparison of their relative merits as adapted to and intimately connected with the successful development of that great industry to which our present organization relates.

The Belgian proverb, "No grass no cattle, no cattle no manure, no manure no crops," is not quite complete; it should continue, no crops no money, no money no intelligence, no intelligence no people—for all people, of whatever nation or clime, possessing no intelligence, that occupy soil where the grasses will flourish, must eventually give way before that resistless march of high civilization that marks its path with the beautiful verdure of blooming fields.

Upon the adoption or rejection of this proverb depends the prosperity and success or downfall and decay of the important interests of our beautiful State.

The fact that so small a portion of the arable lands of our State are devoted to the cultivation of the grasses, is a lamentable one; especially so, as grass is the most important factor in the production of all flesh, which constitutes about thirty per cent. of the human food of the entire world. Again, the importance of grass becomes a more potent factor in solving the great problem that is now awakening the best minds in existence, viz., the preservation of the soil, the foundation of all prosperity, either individual, State or national.

The estimated value of the grass crop of the United States, for pasturage and hay together, is about $1,000,000,000, at the present time. Of this amount Tennessee is entitled to at least one-thirtieth, or thirty-three millions. Deprive us of this amount of property, and issue the decree that there should never be another acre within the limits of our State devoted to the cultivation of grass, and where would we be in ten years from to-day?—occupying a howling wilderness of burned, scarred, gullied, worthless soil; living in huts in squallid ignorance and poverty, the despised of all this great sisterhood of States.

When we realize the great importance that the cultivation of the grasses bears to the successful prosecution of all the branches of rural husbandry, it becomes a cause of sincere regret that the intelligence of our agricultural classes has so seriously neglected to place this important element where it properly belongs, and enable it to stand first in value in all future reports of the statistics of our State.

I will now proceed to name some of the grasses, together with their characteristics, that are the most extensively adapted to and grown in Tennessee:

First on the list, in consequence of its being more extensively cultivated and generally known, is blue grass, (*poa pratensis.*) This grass was introduced into this country by the early settlers of Virginia and the Carolinas, and has since been so extensively propagated from the lakes to the gulf as to deserve the title of *the* grass of America. To describe its specific characters is not pertinent to this occasion, and could only interest the student of botany. This is an early grass that will flourish almost anywhere when properly treated and cared for. It, of course, varies in size and somewhat in appearance, according to soil and latitude of the location. Many persons regard it as the most valuable of all our grasses. This title to first honor depends, in my opinion, upon the character of soil and climate where grown, being a grass that spreads mainly by its creeping roots, and flourishes most luxuriantly upon a porous lime-stone soil where the underlying strata is a tenacious clay. It requires moisture to be always within reach of the roots to keep it green, this being the character of most of the soil in Kentucky, where it constitutes twenty-five per cent. of the

entire wealth of many of the richest counties in that State. It is a grass relished by all cattle. I mean by this term all our domestic animals. It has, in that State and elsewhere, been used as hay, by cutting when in bloom, but I cannot recommend it as a hay grass, being too short and too light after being dried. In our climate it will endure the frosts of winter perhaps better than any other grass. It will not withstand our severe droughts, and consequently should not be grazed closely after June, in order that it may accumulate sufficient growth to shade the roots during the hot months of July and August, during which time, if dry, it makes comparatively little growth unless an unusual amount of moisture is in the soil. To realize the full value of this grass as a pasture grass, it should never have its roots exposed to a broiling sun during summer, letting the fall growth remain untouched until about the first of November, and then it may be grazed until the following June without injury. Upon a good sward, thus treated, all kinds of stock may be wintered with comparatively little cost.

The preparation of the soil for seeding to blue grass is quite simple. If cleared land, plow well in fall and winter, in order that the freezes may comminute the soil thoroughly; harrow in February, sow one and a half bushels clean seed per acre, and follow the harrow with a light brush, as the seed will not germinate if covered deep—by experience not over one inch deep. If woodland, clean the soil of leaves or trash, either by raking or burning, then sow and brush in. The first year the young grass should not be grazed at all, as it requires two or even three years to become well set and does not arrive at perfection until the sward is older than that. The soil should not be allowed to become too loose, which may be prevented by the tramping of stock in dry weather; nor should too much growth be allowed year after year, as it will become greatly injured by self-mulching. The proper time to pasture, after seeding, is after the seed ripens in June, the second year; care should be taken never to graze this too closely at any one time. The nutritive value of blue grass, according to some eminent chemists, is not equal to that of timothy, clover or orchard grass, either in flesh-forming principles or fatty matter. Among the eminent names whose analysis asserts this fact, I would mention Professor Horsford, formerly of Cambridge, Professors Way and Bousingault. Yet these gentlemen may not have had specimens of this grass in its greatest luxuriance; for all have acknowledged it here superior to that in its native country. Notwithstanding these experiments, its many good qualities recommend its general adoption, and whoever has limestone land has blue grass land; whoever has blue grass land has the basis of agricultural prosperity; and that man, if he has not the highest type of domestic animals, has no one to blame but himself.

I will next name orchard grass, (*dactylis glomerata.*) This plant is also a perennial, and in my estimation second to none. It is so well described by that eminent botanist and secretary to the Massachusetts Agricultural

Society, Chas. L. Flint, in his treaties on grasses and forage plants, that I adopt his text in giving a description and its characteristics. He says:

"This is one of the most valuable and widely known of all the pasture grasses. It is common to every country in Europe, to the north of Africa, and to Asia as well as to America."

It was introduced into England from America, and forms one of the most common grasses of English natural pastures, on rich, deep, moist soils. Its rapidity of growth, the luxuriance of its aftermath, and its power of enduring the cropping of cattle, commend it highly to the farmers' care, especially as a pasture grass. As it blossoms earlier than timothy, and about the time of red clover, it makes an admirable mixture with that plant to cut in blossom and cure for hay. As a pasture grass it will bear feeding closer than blue grass, as it grows much more rapidly; and close grazing has much influence in preventing it from forming into tussocks. All kinds of stock eat it greedily when green. It is one of the most abiding grasses we have; it will grow well in either sunshine or shade; five or six days of growth will furnish a good bite for cattle; it will resist drouth when blue grass or timothy will parch and dry up; it will produce more pasturage than any other grass with which I am acquainted. Indeed, if I had my preference of all pastures for grazing stock, especially for preparing sheep or cattle for market, I would by all odds prefer an equal mixture of orchard grass and red clover. The preparation for seeding is about the same as blue grass, and may be sown any time during early spring, or even winter, many preferring to sow during snow, as it enables any one to make a more regular distribution of the seed; by all means avoid a windy day, as the seed are very light and will blow into bunches under the lightest breeze. This grass, like blue grass, should not be pastured the first year, but any time after a year old it may be pastured longer and closer than blue grass; but to derive its full value should not be pastured very close during the hot months. Orchard grass does not stand frost quite so well as blue grass, but has so many superior qualities as to deserve general commendation, and especially that of flourishing upon a greater varieties of soils and in more different climates than almost any other variety of grass. I would recommend it to the cotton States with the full assurance that it, when fully introduced, will prove one of their greatest boons.

Next in importance to Tennessee is red clover, (*trifolium pratense.*) Indeed it is hard to separate or distinguish between the relative values of the three above named grasses. Although red clover is not, properly speaking, a natural grass, it is so closely allied in value and general adoption, wherever successful agriculture prevails, to the natural grasses, that it deserves a place among them in general cultivation. Indeed I can scarcely imagine how successful agriculture can be conducted without it. The renovation of the older States and worn-out lands can scarcely be accomplished without its agency. The successful rotation of crops depends

almost wholly upon this useful forage plant. It is said by agricultural writers that the introduction of clover into England created an entire revolution in her agriculture, and when we consider the important part it plays in our own country, we can with difficulty imagine how our ancestors could farm without it. It is very properly regarded as one of our greatest fertilizers, and certainly by far the cheapest. It loosens the soil and admits the air, sends down its long roots to a great depth, thereby fixing the gasses necessary to enrich the earth, and when these roots decay they form humus, that most important element in the production of food, to the growing plants. Its luxuriant foliage and rapid growth also aid greatly in smothering out weeds and other noxious plants. As a hay plant it is unexcelled when properly cured and housed, its nutritive qualities exceeding that of most other plants, especially in its nitrogenous or flesh-forming principle, and therefore is the best hay for young and growing stock. As a grazing plant for rapid fattening, it is superior to either blue grass or orchard grass, if caution is exercised as to the time and manner of grazing. Nothing is more conducive to the rapid growth and thrift of young animals than a rich and luxuriant growth of clover when in bloom in the spring of the year. The risk of over-feeding by cattle is easily avoided if turned on after the dew is off, and not fed entirely upon it during rainy weather.

So great a factor do I regard this valuable forage plant in producing a general improvement in the agriculture of our State that, were I a king, I would issue an edict that no man should be allowed to cultivate the soil who would not, at least once in every five years, sow clover upon the land he cultivates. The manner of seeding is simple and sure. Plow thoroughly and deep in the fall, in order that the frosts of winter may pulverize well. If your land is seeded to wheat, nothing else is necessary in February or March following, but to carefully distribute about one gallon of seed per acre over the ground. If you wish to seed after oats in spring, or with other grasses, be careful to work the ground to a fine tilth before sowing, which should be done early enough to give the young plants a start before the sun gets too hot in summer. Clover may be pastured lightly in the fall, after sowing, without injury, but is not very nutritious until at least a year old or older. I would here give my mode of curing, which has proved with me quite successful, were it not seemingly invidious, as any man worthy to be called a farmer can, by a little experience, quickly learn to make good, sweet clover; yet there is quite a diversity of opinion upon this subject. I will simply add that the very large per centum of water renders it quite liable to heat, and from which cause it easily becomes damaged. No clover hay can be kept sweet and fragrant until the juices are sufficiently dried at least to become candied.

The next upon the list in relation to its value and importance is timothy, (*phleum pratense.*) I shall not class this grass among the grazing grasses, as I regard its merits in this respect so very far inferior to any

one of the before mentioned three. Its very high rank as a meadow grass, alone, entitles it to a position among the most commendable grasses for Tennessee production. According to Boussingault, Liebig, Way and others, when cut in full bloom, or a little later, and properly cured, it possesses more flesh-forming, fat-forming, heat-producing properties than almost any other grass. Its yield per acre, when well set and properly treated, is a great point in its favor, also the ease of curing and the slight loss from handling are strong points in its favor. This, added to its general popularity, makes it a desirabla grass for general introduction where-ever the soil is adapted to its growth. It delights in a peaty, loamy soil of medium tenacity, and is not suited to light, sandy or gravelly soils. The generally adopted mode of seeding has materially changed within the last decade, when the generally adopted plan was to sow upon small grain, wheat, oats, rye or barley, in the spring of the year. The failure of late years to get a catch in this way, has introduced the now most generally adopted plan to thoroughly prepare the land in summer and seed in early fall, by sowing about one-fourth bushel seed alone, and following with harrow, roller or brush. I prefer harrowing in, after harrowing the ground over thoroughly after plowing, and then rolling the young grass in spring after freezes, to press back the crown into the ground. I think a young timothy meadow should never be cut the first year, unless from an exceedingly wet spring and summer there is a luxuriant growth, and then the mower should be run sufficiently high to leave quite an aftermath behind the machine. Timothy, being of slow growth, if cut too closely the hot sun of July and August certainly injures the roots unless protected, especially the first year. The only pasturage that can be derived from a timothy meadow is in the late fall, and then only at the risk of lessening the succeeding crop. I think the yield of hay per acre of a timothy meadow can always be increased by combining it with clover, herds grass or orchard grass, but they will lessen the market value of the hay. The lands of Tennessee well adapted to the growth of timothy are not very extensive.

Red-top or herds grass, (*agrostis vulgaris*), until late years, numbered among the meadow grasses only, and limited in its cultivation to such localities as were too wet for the successful growth of any of the foregoing. It was supposed by most persons to succeed only on low, marshy, flat lands. Recently, however, it is becoming a great favorite and more generally adopted. It is now being sown upon quite a variety of soils in different parts of the State, and I have recently ascertained that it is becoming a spontaneous growth along many of the mountain ranges of East Tennessee. My experience with it is comparatively limited, and I will not venture to give any very decided opinions about it either as a pasture grass or hay plant. It is highly recommended by such authorities as Flint, and other prominent agricultural writers of the country. My own opinion, from a limited experience, is that it is a very valuable ad-

junct to our meadows in thoroughly covering the ground and thus shading the ground, thereby enriching the soil by preserving its humidity during the summer.

I have thus enumerated the more generally known and important grasses grown in Tennessee, and will now close with a short notice of a few others generally known as forage plants, that have played an important part in the production of animal food, and which hardly belong to the grass family. The millet family, (*milium*,) although they have heretofore been useful as a hay-producer in the rotation of crops, being annuals, and producing large yields per acre, a more general enlightenment and familiarity with agricultural science has numbered their days, and now only grown in cases where dire necessity compels a complete covering of the ground in order to kill out some noxious pest, or where the land is owned by a man that is "non compos mentis." This family comprise Hungarian grass, German or Missouri millet, the old Southern or Egyptian millet, Dhoura corn, broom corn or sorghum sacharatum and Chinese sugar cane, all of which are great exhausters of soil, by far greater than the profits, possess but little merit as forage plants, and the cultivation of which should be universally condemned by all good agriculturists from the mountains in the east to the waters in the west.

B. F. COCKRILL.

Richland stock farm, Feb. 19, 1878.

GRASSES IN BEDFORD COUNTY.

SHELBYVILLE, TENNESSEE, BEDFORD COUNTY, January 15, 1878.

J. B. Killebrew, Commissioner.

DEAR SIR—I have thought that a description of the grasses grown in this county (Bedford), and the large number of acres that are peculiarly adapted to their growth, would interest you. Soon after this became a county, blue grass was sown on one of the knolls of this county, and about that time it was found growing on a hill called Bald Knob (because it has no timber on it), near Wartrace depot, and on another near Bellbuckle depot. On a farm then owned by Thos. A. Peacock, Esq., and now by the estate of the late Chancellor Steele, and a little later on the place occupied by our Agricultural Society, as a fair ground, blue grass was sown. From these points blue grass has spread very rapidly, and much has been sown in different parts of the county.

At this time our pasture lands are green and bright, with a large number of stock grazing contentedly on them, in many instances fat and sleek as if it were May. Our farmers prize this grass very much, and I feel confident when it has been kept for a winter pasture that it (with the aid of some straw, corn husks, or hay for their stock when the snow lies deep on the ground), can graze about as many cattle or sheep in the winter as in the summer time; this has been done by Robert L. Rankin on his farm néar Bellbuckle depot and by several others. There is scarcely an acre of our land that is not "glady" that will not produce blue grass, and fully one half of our land will produce this grass equal to any lands on this continent when it is properly cared for.

In addition to blue grass for pasturage we have learned that herds grass (red top) makes a most excellent pasture, in fact it stands the hot sun and drought of our summers better than either blue grass or orchard grass; it affords abundant grazing late in the fall and early winter and very early in the spring, and all kinds of stock love to graze it. In addition to these two, many have been trying orchard grass for grazing purposes; all like it and say that it is a very early grass and stands our mild winters well, and having a much larger and longer leaf than blue grass yields a very large amount of grazing. Some say it is earlier than blue grass, and many persons who have tried both grasses give it the preference, for in addition to its excellent grazing qualities it makes a first class hay, and when red clover is sown with it many persons regard it as the best meadow a farmer could have.

The writer once owned a pasture of 15 acres on slightly undulating land, well set with blue grass, orchard grass and herds grass, that for fifteen years was one of the best pastures he ever saw, and there was no season of the year that cattle and sheep could not find good grazing there, and in the spring, summer and fall months it appeared to be almost inexhaustable.

This county is one of the very best in the State for meadows mixed with timothy and herds grass. We have frequently seen in our meadows, timothy 4½ and 5 ft. high, growing by the side of herds grass at least 3 ft. high and sometimes higher, standing very thick upon the ground and producing at least two tons of excellent hay to the acre, and this on land, never top-dressed with any fertilizer, the only manure ever placed upon them was done by the stock as they grazed in fall and winter. A large amount of the acreage of this county makes the very best meadows, and there are lands where blue grass grows most luxuriantly; but we have from 75,000 to 100,000 acres of land that is very level, known as the "Flat Woods," on which meadows of the first quality abound.

Our farmers are turning their attention each year more and more to grazing and meadows, and find that hay is the most remunerative crop that can be grown by them for the labor and expense required to produce it. The grazing after the hay is removed from the meadows compensates the owner for the expense in harvesting his crop.

In addition to these grasses, red clover is grown more or less by almost every farmer in the country, the most of which is kept for grazing; but many of our farmers save it for hay, which is easily cured and the yield per acre is very large. Those who grow clover for hay, as a rule prefer it for cattle, sheep, horses and mules, to any other. White clover is a spontaneous growth in this county, and shows itself in fields not cultivated and in pasture land. It is good grazing for cattle and sheep at any time, and for horses and mules until the seed ripens.

Long before the war we found that grasses and clover paid a better per cent than cotton, and its cultivation was almost entirely abandoned. The result was a large increase was seen in the number of cattle, sheep, horses, mules and hogs on our farms, and instead of our lands being exhausted by the cultivation of cotton, their productiveness has been preserved and to a large extent it has been increased; and will continue to do so as long as our present system of rotation in crops is preserved.

This is one of the largest hog raising counties in the State, and this is attributable to the abundance of red clover grown, for from the 10th of April until late in the fall it affords excellent pasture for hogs, and many sell their hogs from these pastures for early fall shipping, after being fed but short time with corn. Our most successful hog raisers rely upon their clover for grazing their hogs, and corn, which they grow in great abundance, to fatten them. It is a matter of constant surprise to those who do not understand the capacity of this county to produce grasses, clover and corn when they see, as we have done constantly through the past year, carload after carload of hogs driven to our town for shipment, where our packers, Barrett & Landis, could have found the fourteen or fifteen thousand hogs which they have packed during the past season, averaging over 260 lbs., and at the same time that the county should be more than supplied with pork for this year's consumption. These facts are to be attributed to the great care our farmers give to their clover fields, and the corn producing capacity of our lands, and we find that clover grows more luxuriantly as we increase the fertility of our soil by the growth of clover and other grasses. Saplin clover does well here, and we have seen it grow over 6 feet long, but the red clover is preferred for all purposes except to turn under as green sod.

Two gentlemen this winter have informed me that they have each a field of clover upon which there is an excellent stand and growing

finely, which were sown over ten years ago and that one crop of corn and two of wheat have been grown on these fields since they were sown.

I might multiply instances of this kind, but I deem it unnecessary to you who have seen in the past so much of this county and know its adaptability to the growth of grasses and all the cereals. Coupled with these advantages, we have a large amount of pure running water upon the surface of our lands, so it is not a matter of surprise that we should ship such large numbers of stock of every kind, and that we should claim this as one of the best stock-growing counties in the State. Our people are freer from debt than those of any county of our acquaintance, and the fact that lands where blue and orchard grasses grow have, in more than one instance, sold from $50 to $55 per acre, in payments, almost equal to cash, without scarcely a dwelling on them above a cabin, but having good barns, speaks well for our prosperity.

As farmers, we have learned to feel that grass is our sheet anchor and with it we will continue to sail on to greater prosperity each year.

I have already made this letter too long, and will cease to write more for the present, hoping to see you with us soon, I remain your friend,

THOMAS H. COLDWELL.

GRASSES IN ROBERTSON COUNTY.

Cedar Hill, Tennessee, June 21st, 1878.

J. B. Killebrew, Commissioner of Agriculture:

Dear Sir—Your letter was received some time since asking me to give you a few items on the grasses and their adaptability to the soil of Robertson county, and, although I entertain your doubts about the value of what I can say on the subject, still will try to give you the result of my observation and short experience.

Owing to the nature of our soil, blue grass is not so spontaneous or luxuriant in its growth as in the counties lying in the Central Limestone Basin of Tennessee, nevertheless, it flourishes in this county, and wherever the timber has been removed and the seed sown on the virgin soil, this grass grows with great vigor. The leaves of our white oak timber are so abundant and decay so slowly that they will smother out all the grasse

unless the trees are nearly all cut down; but under the black walnut blue grass is invariably found, and always so luxuriant as to lead to the conviction that there is some strong affinity between them.

Owing to the red clay and the layers of chert underlying our soil which enables it to withstand dry, hot weather without parching, blue grass is more reliable in a season of drought, and much less frequently killed during summer in Robertson than in Davidson and the contiguous counties. It is also a noticeable fact that in our old fields, which from one cause or another, have been abandoned and suffered to go for several years without cultivation, blue grass springs up spontaneously, and if the black berry briers and the broom-sedge, our greatest pests, are burned off a few times to give the grass a fair opportunity to take root and to spread, it soon forms a fine, rich pasture, fresh and green all the year round. Our red clay sub-soil is a great element of resuscitation, and when exposed to the disintegrating effects of thawing and freezing it soon begins to form a new soil on the galded spots so common on the hill sides of the country, and if a little brush—cedar is the best—or straw or litter which will catch and hold the particles of loose clay be thrown on these thin spots, and then blue grass seed be freely sown among the brush, we can soon transform our red-fluted old fields and reproachful looking worn out spots into excellent pasture land. I have seen this so fully and sufficiently tried as to thoroughly establish its success. Herds grass or red top will accomplish the same purpose, and will perhaps grow even more rapidly, though it will not afford so much grazing. The blue grass seems to flourish equally well on hills and bottom lands, but as unfortunately corn and tobacco almost exclusively occupy the attention of our farmers, we have in the county but a limited number of acres, which, beautiful in their perennial green coat of this king of grasses, delight the eye wearied with the sight of endless cultivation.

Orchard grass grows well, and is especially fine for pasture, ranking in this particular both for winter and summer grazing, next to blue grass, and in many places is pronounced superior to it. It thrives on either high or low lands, but, of course, grows best on the richest soil, and if mixed about half and half with clover, will make excellent hay. If sown by itself, the heads being large, one, by using a hand stripper, can easily save his own seed and multiply his pastures indefinitely. It grows in tussocks, and if not sown thick enough at first, as is very apt to be the case, by allowing it to go to seed and to fall down, it very rapidly thickens itself to almost a perfect sward. It may be sown either in the early fall or early spring. March I regard the best month, and the ground should be thoroughly prepared.

Herds grass is more extensively cultivated in Robertson than any other grass, and this fact would naturally lead to the belief that on our soil it is best suited for general purposes, both of pasture and of meadow. While it does not afford the grazing of blue grass it makes a fair fall and winter

pasture, and will yield a satisfactory crop of hay. It grows well on all the varieties of land and soil, and where the soil is thin and mixed with that whitish clay found in the poorer parts of the county, I think it is the only grass which will give a paying crop of hay. I have no hesitancy in pronouncing it pre-eminently the grass for *thin, wet* or clayey lands.

Timothy, with many of our farmers, is the crop most relied upon for hay, and on good land it is a highly remunerative crop. As but little hay is sold, and that never weighed, I cannot estimate the yield of this grass per acre. A meadow under ordinary circumstances will not last longer than four years, by that time it is generally ruined by broom sedge. Our timothy meadows make good sheep pastures from November till April without sustaining any estimable damage. A smooth soil, loam and clay, and high lands are better suited for timothy than the siliceous and gravelly soils, and the stronger the land the better the meadow will be. Timothy should be sown here, unless the fall is very dry, in September, so as to allow it to become well rooted before the freezes come, and it should be covered with a roller. It is best to sow it by itself, in which case it will yield a fair crop of hay the next summer. It is more frequently, however, sown with wheat. This practice is unwise as only a small crop of wheat can be made, and that at the expense and injury of the meadow, which is expected to last several years. Timothy sown in the spring does not do well, as it cannot get sufficient root to stand the heat of summer.

Clover is more generally used for pasture than any other grass. Its popularity is due to the fact that it can be seeded at a small cost per acre, and that it affords good summer grazing, and if not used in this way, is a most valuable crop to turn under. Though, like blue grass, it does not flourish here as in the Limestone Basin, still clover grows luxuriantly in Robertson county. On fresh land which has been cultivated for a few years in tobacco and then sown in wheat and clover, I have seen clover that could not be surpassed any where. It is frequently cut for hay, and for hogs is the best pasture we can have, putting them in fine condition to fatten. It grows on all of our lands; is fine to renovate tired and worn soil. But for hay should be sown on rich land whether hill or bottom. It is sown in the spring on the small grains, but it is best to sow it with oats, for thereby it gets the advantage of a good, loose seed bed, thoroughly prepared at the time of sowing. When a good stand of clover is once obtained, and the seeds have been allowed to ripen and to fall on the ground, it rarely becomes necessary to sow again. I know personally of hundreds of acres on which there is a splendid stand of clover, where there has not been a seed sown for over twenty years. During this time the fields alluded to have been cultivated every second or third year in corn or tobacco followed by the cereals, and as regularly as these crops have been taken off so they have been followed by a fine growth of clover. The theory prevails here that by cultivation the root of the clover is killed, but that quantities of seed which lie deep in the ground for years without sprout-

ing or rotting are brought to the surface by that same cultivation, and they germinate and grow with the crop of wheat or oats. Owing to this fact clover possesses a value and property peculiar to itself, and at once become the cheapest grass we have.

I have now given you as concisely as I could the perennial grasses grown in this country, the uses and adaptability of each to the various kinds of soil, and nothing remains but to add that fortunately the raising of annuals, such as millet and Hungarian grass for hay has been almost entirely abandoned, both on account of their inferiority as feed and the cost and labor of saving the crop. For the latter reason coupled with the fact that it has suffered terrible ravages from rust during the past few years, the oat crop has also greatly diminished. I hail with delight as foreshadowing greater prosperity and better cultivation with less labor, the seeding of meadows and the sowing of the perennial instead of the annual grasses. In this respect this county is far behind many others, and while I readily concede that for quickness and spontaneity of of growth many lands in the State are better suited for the pasture and meadow grasses than ours; still when we consider our eminent superiority in a season of drought, or even in the ordinary heat of summer, I feel that old Robertson can fairly hold her own in the sisterhood of counties

With great respect I am your obedient servant,

JOSEPH E. WASHINGTON.

CORN AND ITS CULTURE.

The grass family (Graminaœ) is extensive, and by far the most valuable to man. Indian corn or maize (*zea mays*) is the largest of all grasses. It stands foremost in value as food for man and beast, and if properly cultivated, is the surest crop the farmer can raise. No cereal is grown with less difficulty, nor is there one that pays so well. An examination of the structure of the stalk in ear shows that it is composed of ten divisions, roots, stalk, sheathes, husks, stalks of ears, leaves, silk, tassel, cob and grain. The roots are divided into three classes, the main or primary, the secondary and the brace or aerial. The first of these disappear very soon after the secondary roots begin to perform their office, and the brace roots show themselves soon after the stalk

begins to joint. Like many other plants, corn is an inside grower, (endogenous,) consisting at first, of whorls or circles of leaves one within the other, over lapping each other on either hand until the entire stalk is grown. It is interesting to notice right here the difference between the grasses. Some are hollow while others have a pith. The leaves are the lungs of the plant. Their very important office is to take on or absorb carbonic acid gas from the atmosphere. Having received this the plant appropriates the carbon to its own use and at the same time throws off oxygen. This operation goes on only in the day time, the sun's light and heat being the great resolving agent. The sheathes do the same thing, and also serve as a protection and band to the tender shoot. The husk at first envelopes the cob and silks, afterwards the grain. It feeds both cob and corn with elements obtained from the atmosphere. The cob is the axis on which the kernels are regularly set It is the direct feeder after the embryo grain is formed and fecundated by the pollen through the silk. The tassel (staminate) contains the male, and the silk (pistillate) the female part of the plant. The pollen from the tassel falls upon and fertilizes the silk and the silk the grain. If from weakness or other causes the silk fails to come out of the husk to be impregnated by the pollen the corn fails to appear or develop on the cob; hence the vacant rows so frequently seen on the cob.

A further examination of the stalk shows an ear, or the commencement of an ear on every joint that has a groove. Generally about two-thirds have it, and in every one is seen an embryo ear undeveloped. The question arises right here, why this incomplete development? I have contended for several years that every such organization would develop on every grooved joint were proper attention given to selecting and sowing seed, to proper culture and proper plant-food.

Like all other cereals, corn has so deteriorated by bad treatment that it has not health enough to mature even one good ear to the stalk. With ordinary treatment all other grasses develop their heads or ears to some extent, and why should not corn do the same? For several years I have been giving corn and wheat some attention. I find corn susceptible of much greater improvement than most farmers are willing to admit. It is not in the province of this article to give the results of experiments. I will, however, give one to prove that there is much room for improvement of corn. Several years ago I commenced selecting my seed corn *in the field*, taking only those stalks that ripened earliest and that had not less than two good ears. These were cut up as soon as the husk was brown and the ear well glazed, and shocked in the field to cure. After standing a month or more the *top ears* only were saved *for seed.*

Great care should be taken in selecting not only those stalks that have the greatest number of ears, but those that look most like corn—nice, trim, uniform, vigorous and healthy. Large over-grown stalks are too gross and too sterile—they cannot be made prolific. The result of this method of saving seed, together with proper culture, has increased my yield on the same six acres, in six years, from 20 to 75 bushels per acre.

Before treating of the soil, I will give an account of the actual loss most farmers sustain in "pulling fodder," "cutting tops," and letting their corn dry up in the field before it is gathered. Fodder-pulling injures the grain nearly 13 per eent., cutting tops 9 per cent., and by letting the whole crop dry up in the field, it loses 20 per cent. of its own weight. So you see by this slip-shod way of treating the best and surest crop we have we lose nearly 50 per cent of it all. How shall we save it then? you ask. In a very simple way. When fodder-pulling time comes and the ears are well glazed, instead of taking the blades off, cut the stalks up close to the ground, and shock immediately in bunches the wind cannot twist or blow down. In this way the fodder is all saved, and the stalk too. The husk is much better and the corn loses nothing, but makes much better food, much better feed, much better seed and much more money. "But," you say, "it will shrivel and become loose on the cob." Not a bit of it! All the substance of the stalk at the time of cutting is absorbed by the ear, and it is matured in the same way that wheat is when cut in the dough state. This method insures the full weight, and saves the 20 per cent. lost by the old plan.

Another item. The stalk fodder and husk cured in this way are worth at least $3 per ton to any farmer; whereas, if left to die in the field, they will not amount from a hundred acres to a day's wages.

Any soil can be made to produce corn, provided it is not too wet. Soils differ so materially even on the same farm, that the farmer, to produce good crops, has to make them a real study. Once knowing them, and what they need and demand, he very easily increases the yield. For corn, land should be plowed, turning the sod only as deep as the grass roots extend, at the same time subsoiled with a heavy subsoiler and a strong team. The best fertilizer a farmer of limited means can use for his corn crop, can be made behind his cows. Straw, chaff, leaves, muck, surface soil, barnyard scrapings, refuse of every description, well tempered with the droppings and manure water of the cow stalls make as good compost as the farmer needs. His compost heap must be kept under cover, and should be turned over at least once a month. The straw, chaff and leaves should never be thrown upon the heap until the cattle have well wet them.

In conclusion, I must urge upon my brother farmers the importance of putting in less land and preparing it better. With good seed, one acre well cultivated will yield 50 bushels, which gives infinitely more satisfaction and is done with much less labor and expense than the skimming over of ten acres with the same result. Almost any of our upland soils can be made to produce 50 bushels by a little scientific culture and saving of seed.

A. E. BLUNT.

Agricultural Station, Mouse Creek, East Tennessee.

The following article on Sorghum was, by accident, left out of its proper place, which should have been under cereals.

SORGHO SUCRE.

CHINESE SUGAR CORN—(*Sorghum nigrum.*)

Has an erect stem, six to twelve feet high, smooth; leaves linear, flexons, curving, bending at the ends. Flowers in a panicle at the top, turning as it ripens from a green to a purplish color.

In 1854, some insignificant packages of seeds were sent from the, then, patent office, bearing this inscription:

"SUGAR MILLET.

(*Sorgho Sucre.*)

(Good for fodder, green or dry, and for making sugar.")

Who could have foreseen, from these few characters, that a plant was then being added to this country more important than any since the discovery of America and the discovery, to Europeans, of Indian corn?

In the midst of the great success of the New World in agricultural products, the

Old World sent this boon to her offspring as a token of good will; and, in introducing it into notice, the agent, Dr. J. Browne, has done more real, solid good, than all the great conquerors of the nations. If the Agricultural Bureau of the United States had never done aught else, this one thing would more than have compensated for all the expense it has been to the Government. It has added the one thing needful to the farmer, it has made him independent and enabled him to raise his own supply of syrup, if not of sugar.

But see how modest, "Good for fodder, green or dry, and for making sugar." And thus this humble package went to the country, seeking some one to make it famous. Many, very many, threw it aside altogether. Some planted it, and gave it untried to their stock. The stock soon told its value as a forage, and some few squeezed a tumblerful of its juice and tested it with the saccharometer. They found about 16 or 17 per cent. of sugar. Some tasted it, and it *tasted sweet.* Two made a gill or two of syrup, and, not knowing how, did not report much success, but promised to try it next year. All concurred in one thing, it was a great accession to the forage crop of America. And yet this plant was destined at a very early day to supply the poor of the South with the great and almost the only luxury of a long, tedious and bloody war.

But the reports, meagre as they were, satisfied the Department: it was all that it had been represented. So the successful experiments were published and more seed was procured and broadly distributed over the land. The second year, a furor began. It jumped at once into popular favor and established itself, not only as a magnificent forage crop, but also as a syrup cane. Within a year or two. sugar has been made from it of good quality, and during a recent visit to the Agricultural Department at Washington, I saw specimens of sugar manufactured from a new variety as excellent in flavor and color as the best New Orleans

sugar. I distributed some of the seeds of this new variety, and I confidently predict that Tennessee will, in ten years, make sugar enough for her own consumption at a cost less than five cents per pound.

HISTORY.

In the fall of 1853, Dr. Jay Browne was sent by the Department of Agriculture to Europe, to gather seeds for distribution from the office. He saw a small patch of sorghum at Verrieres, near Paris, and being struck with its resemblance to corn thought it would be an accession to our forage crops, and possibly might be used as a sugar plant.

Four years before, M. de Montigny had sent the seed from the North of China to the Geographical Society of Paris, in a package of many different kinds of seeds. They were planted, and but one single sorghum seed germinated. The product of this plant was distributed, and the next year, so great was the demand, a gardener of Paris sold his entire crop to Vilmoriu, Audrieux & Co., of Paris, for a franc a seed. Through them it was sent over the whole of Europe and America, for it was on their farm Mr. Browne saw it growing.

In 1850, Mr. Leonard Wray, of the East Indies, a practical sugar planter, on a visit to Kaffir-land, found the *imphee*, another species of sugar cane, growing around the huts of the natives, which they cultivated for its chewing qualities. On examination, he discovered its rich saccharine character, and was satisfied of its value. He therefore brought it with him to England and had it planted there, as well as in France and Belgium. He memorialized the French minister of war, and also Mr. Buchanan, who was minister in England at that time He afterwards cultivated it in the West Indies, Brazil, the Mauritius, Australia, Turkey, Egypt and in this country.

The Kaffirs cultivated sixteen varieties, that differed in the amount of saccharine principle, as well as in the time

required to mature. In 1856, Mr. Wray exhibited sugar, molasses, alcohol, plants and seeds of the *imphee* at the Paris Exposition, and not only obtained a silver medal, but a grant of twenty-five hundred acres of land in Algiers was made him by the French government, that he might prosecute his researches. During this same year, Orange Judd, of New York, distributed 25,000 packages of seed to his subscribers, speeding them throughout the country. In 1857, Mr. Wray brought to the United States the seeds of several varieties of Imphee. So then, when Mr. Browne obtained the seeds it was really in its initial state of cultivation in France. It had been grown in China from time immemorial. But with the exclusiveness of that people, its very existence had been jealously guarded from the world.

The same, or a similar plant, had been cultivated in Europe at different periods during the dark ages, but the want of intercourse, and the oppressive feudal system of that day had repressed any advancement in science and arts, as well as in agriculture.

The elder Pliny, in the first century, describes a plant under the name of *milium quod ex India in Italium invectum nigro colore*, (a millet of dark color brought from India to Italy). Millium means thousands, and refers to the number of seeds on a plant. Fuchius describes, in 1542, a plant cultivated in Belgium, called Sorghi. In 1552, Fragus says, in a work on botany, a *Panicum Plinii* was cultivated in Germany, and accurately describes this plant. In 1591, Gesner names this same plant *Sorghum*. In Italy, in 1595, in his commentaries on Dioscorides, Matthioli calls it, *Indicum Milium*, or Indian millet. Gerard, an English writer, in 1597, describes this and other varieties of Sorghum, as Dhouro corn, Broom corn and Chocolate corn.

Thus it is seen, that this plant, however new to us, was cultivated in England, Belgium and Italy, in the 16th century, and that it was known to Pliny in the 1st century.

Its uses were described as so various, that it is supposed all the varieties of Sorghum were confounded by these different authors. It was recommended as fodder for stock, food for poultry and hogs, and for a syrup; while the Italians called it *melica* from its resemblance to honey. It was described as having seeds, various in color, from rufous to black, from white to yellow and red, and they were said to make an excellent bread. The bread had a pinkish tinge, being colored by the husks, which could not be entirely separated from the seed. Through the caravans of the Syrian desert, Sorghum was carried from Asia to Africa, and there, under the changes of climate, soil and moisture, new varieties originated, and we have the Imphee canes.

Linnæus calls it *Holcus Saccharatum*, and the Dhouro corn he calls Holcus Sorghum. But Persoon, and others since, have separated the two, and applied to the sugar cane the general name Sorghum, and its specific name Nigrum, from the color of its seeds. These plants are all called Sorghum in the East Indies.

VARIETIES.

There are many varieties of cane, and, while the description at the head of the article will give the generic characters, it will not the specific differences of the various kinds. But it is not necessary to give the botanic description of each variety.

1st Race—Eusorghum.

True Chinese Sugar Cane, (already described).

2nd Race—Imphee.

1. Prœcocia, (early Sorgo). 2. Ooui-se-a-na, (Otaheitan). 3. White Imphee, (Nee-a-ga-na). 4. Black Imphee, Nigerrima). 5. Red Imphee, (Cerasina, cherry red) Shla-goo-va. 6. Liberia, (Liberian).

In Tennessee, the nomanclature is shortened by all being called "red," or "black," and "Chinese," or "African."

Sorghum. submitted to a pressure of ten tons, will yield about 60 per cent. of juice, leaving 40 per cent. of woody fibre, gum, juices, etc. Of this 60 per cent., about 10 per cent. is sugar, both cane and grape, or, if not 'reduced to sugar, it will make about 25 per cenf. of syrup, or 15 per cent. of the expressed juice.

However, in fact, this amount varies very much, according to the soil on which it is raised. On rich bottom land, where the cane grows to be very tall and large, there is more water and less sugar in the juice, while on poor, sandy, dry land the proportion is much greater. In some specimens of syrup, when boiled down thick and allowed to stand, crystals of sugar will form all through it. These crystals are in the form of a modified rhombic prism. But in the generality of specimens, from the presence of an acid, the cane sugar is converted into glucose and no manipulation is sufficient to cause it to crystallize. A few years ago, at one of the expositions held in the city of Nashville, a jar of this sugar was on exhibition, and there is a fair specimen now in the cabinet of this Bureau, and, as before stated, some excellent specimens at Washington. Should an early and cheap means be devised to secure rapid crystallization the result will be to bring down the price of sugar. Molasses, which sold at one dollar per gallon, was brought, by the introduction of sorghum syrup, down to twenty-five and thirty cents. There is so little difference between this grape and cane sugar, that it is to be hoped some process may yet be invented by which the syrup can be crystalized at will. The constituents are the same, only having one equivalent more of hydrogen and oxygen than carbon. It is undoubtedly due to the presence of some acid, as cane sugar can be converted into glucose, by the addition of acids, or by passing a stream of air through the boiling syrup. In this inventive age the mind of man has only to be turned to this subject and it will be done.

The Imphee cane, as a rule, produces more crystals in the syrup than the Chinese, consequently the latter is more universally cultivated, being better suited to making syrup. Besides, the African or Imphee cane grows much taller and is easily blown down by high winds, making a tangled mass in the field, very difficult to harvest.

CULTIVATION AND HARVESTING.

Sorghum will grow and thrive, like Dhouro, on the poorest soils. When the earth is parched up by drought it maintains its fresh, green color, and continues to grow. However, it will thrive better on rich land, and, though the juice may have more water, it will make far more syrup. The roots of sorghum penetrate the soil farther than any other cereal, and consequently deep plowing is absolutely requisite for a full crop. Not only should the plow, but the subsoiler should also be applied. On good land it grows to a hight of 15 to 18 feet, on poor, badly prepared land, it stops at five or six feet. Because it *will* grow on poorer land than other plants is no evidence that poor land is better for it. Therefore let the land be in good heat and the increased quantity of syrup will well repay the labor. On gravelly or sandy subsoils, the roots will go four or five feet deep, and on this kind of land, if rich, it will make far more syrup and of a better quality.

It should be planted in drills three feet apart, and in four or five days the young tender stalks will come up, looking very much like grass. But it will soon begin to grow rapidly, and outstrip grass or weeds. When three or four inches high, it should be chopped and thinned out, and but little more work need be done to it. Two plowings are all it should receive, as the roots penetrate the ground so thickly the plant would receive more injury than benefit if plowed after it is three or four feet high. Besides, by that time the ground is so shaded by lateral branches and suckers the weeds will effect no material injury.

Much difference of opinion existed at first, and still exists, as to the best time of cutting. Some assert when the seeds are in the milky state, others when they are fully matured, is the most favorable time. A slight degree of frost does not injure it, and this opinion has caused the loss of many a crop, for, with our usual procrastination, this belief is allowed to influence many to let it stand until a severe frost comes, when the cane is rendered worthless. Whenever it freezes, fermentation ensues, and it will not make syrup at all, or if it does it is black and has a disagreeable odor. But repeated experiments have demonstrated the fact that early cut cane makes the best and cleanest molasses. Still if the farmer has a large crop, he will have an opportunity of testing it in all stages, for it will take a long time to express the juice of a large crop and boil it down.

When the seeds are in the milky state, let the stripping and boiling begin. It is not our purpose to go into a lengthy detail of syrup making, it being rather our province to treat of sorghum as a cattle food, than otherwise, and we will only give a general description. Besides, since the invention of cane mills and evaporators, there is hardly a man in the State who is not thoroughly conversant with the process. One thing every one should bear in mind and that is, do not be too particular to press every particle of juice from the stalk. The first pressure well applied will get, generally speaking, all the saccharine principles, the second pressure only sending out gums, cellulose and some coloring matters. The syrup would be clearer and sweeter if the outer rind of the stalk could be stripped off and only the pith submitted to pressure. Let the juice be strained in a blanket, and boiled as rapidly as possible in a shallow pan. This is all that is requisite. Some use the continuous, some the interrupted pans. The former are becoming more generally used, that is, pans that receive the raw juice at one side and discharge the molasses at the other. Sometimes it happens that the syrup when boiled to a sufficient

consistency does crystallize without any known cause. When it is discovered to do so, the farmer might take advantage of this accident and very easily make his own sugar. And to test its capacity to form crystals a small quantity at various times of evaporating might be boiled to a point lower and thicker than for syrup and set aside to stand two, three or four days. If crystals are thrown down in the vessel there is then reason to believe more of it will do so. He can, therefore, should he desire to make his own sugar, boil it to the proper consistency, or until the steam comes up through the syrup with a burst, and set it off in tubs to granulate. Sometimes, however, this does not take place for a few weeks, or even months. In order to expedite the process, it should be kept in a close, warm room, heated up to, at least, 90 degrees. This can be easily done by having the tubs or barrels of syrup in a room made tight, and heated by a stove. With but little replenishing of wood the stove may be kept hot continuously. When the granulation has taken place fully let the whole mass, molasses and all, be put into stout cloth bags and hung up to drain. Or it can be put into conical tin moulds, shaped like a sugar loaf, with an opening at the bottom covered by a wire sieve such as is used for straining milk. The bags, however, are cheaper and equally as effective. Here let it remain for a sufficient number of days, to allow all the molasses to pass off. It can then be taken down and mixed with a very small quantity of water and redrained, and this application of water can be repeated until the sugar becomes as white as desired. The water can then be reduced by evaporation, to to the desired consistency of molasses. There are many other processes, and machines for making sugar, that have been invented, for sale, but they all resolve themselves into the above at last, which process belongs to any one who wishes to use it.

In the manufacture of the Southern Cane sugar, lime water, (white wash) is used to clarify it. At first this was

used in sorghum, but it was soon found that it blackened the syrup so much that no after treatment would restore its clear color. Besides, it gave it a very disagreeable alkaline taste. Afterwards the white of eggs was used, which did very well, but further manufacture brought out the discovery that it contained so much gum it would coagulate and clarify itself better without the addition of anything with it. Skimming easily removes all impurities that arises upon the surface.

The amount of syrup procured from an acre of ground is as various as are the methods of cultivation and characters of the soil. From forty to two hundred gallons may be considered the range, and when it is considered that a cultivator can take his choice between the two quantities, it may seem that there is cause for emulation.

But it is rather as a forage crop that this plant properly belongs in this treatise. Its uses are almost as various as Indian corn itself. As has been already stated, it is greedily eaten in all stages by stock of every kind. The seeds are abundant, and one acre of good corn will make from forty to sixty bushels of seed. These can be cut from the corn and stored for use, taking care to spread the heads until they dry, when they make good food for cattle, horses, sheep, hogs and poultry. When ground into flour they make good bread. Both the seeds and the expressed juice have been extensively used in distillation, large quantities of alcohol and sorghum brandy being annually made from them. During the war it formed almost the only resource of the South for whiskey, all grains being in too much demand for distillers to use them.

But probably it possesses more good qualities as a green soiling plant than any other one. Let it be sown either broadcast or thickly drilled with a seed drill very early in the spring, with about one bushel of seed to the acre, and there is no end to its feeding capacity. It will yield from 20 to 30 tons of green fodder to the acre, that, when dry,

will make three or four tons of the sweetest and best of hay, and stock will eat up the last vestige of it. The proper time for cutting is when the heads begin to flower, when it can be cut and bundled as corn fodder, or left spread on the ground, if the weather is good, for several days, and it will dry enough to store but not in too large a bulk. Its stems are so succulent that it will not cure quickly, the juices in it, however, will sugar directly, and then it will keep as well as timothy. It possesses fattening qualities in an eminent degree, and nothing like it was ever used for improving a drove of mules. But if the farmer has a drove of mules or herd of cattle or milch cows, it can be fed to them from the the time it is two feet high, and they will eat it with avidity. By the time a field is gone over, it will be ready to cut again, as the root freely throws up new suckers, and will continue to do so until stopped by the frost. Thus, as many as three crops can be cut before it is destroyed by the cold. Or, if it is not wanted as green forage, it can be cut at blossoming, at least twice, without resowing. And the second crop will be as good as the first. A mule raiser in Williamson county has several large racks, and as soon as the hay is in condition to cut, he draws a load to each rack daily, and the mules are allowed to go to it *ad libitum*, so the farmer has only to give them grain to complete the process of fattening.

With the introduction of sorghum into Tennessee agriculture, it does seem that the last desideratum of the farmer is supplied. With a climate the most salubrious and equable, a soil the most various and comprehensive, it sends into the market, annually, grain and hay of every description. Her cattle and sheep are sent in large numbers into Northern cities, while her mules and horses supply the teams of the South. Fruits and vegetables anticipate the gardens of the North, and now she is able to draw a plant from Africa or Asia to supply her people with an ample quantity of home-made syrups and sugars.

In 1870 the total production of sorgum molasses in the United States was 16,050,089 gallons against 6,749,123 gallons in 1860.

			Gallons.
Indiana produced in 1870			2,026,212
Ohio	"	"	2,028,427
Illinois	"	"	1,960,473
Kentucky	"	"	1,740,453
Missouri	"	"	1,730,171
Tennessee	"	"	1,254,701
Iowa	"	"	1,218,635

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